TR114 Universal PCI Board

Hardware Manual

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Brooktrout Technology®

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Preface

This manual explains how to configure, test, and troubleshoot four types of TR114 Universal Peripheral Component Interconnect (PCI) boards:

- PCI Loop-start
- PCI Direct Inward Dialing (DID)
- PCI Combo
- PCI Basic Rate Integrated Services Digital Network (BRI)

Before using this book, install your TR114 and connect your phone service following the instructions in the hardware installation guide included with the board.

The Preface contains the following sections:

- About this Guide
- Introducing the TR114 Fax Board
- Contacting Technical Support

About this Guide

This hardware guide explains how to configure and test the Brooktrout TR114 universal PCI fax boards with either loop-start, DID, or ISDN BRI telephone service.

Chapter Topics

This guide contains the following chapters:

Chapter 1	This chapter explains how to configure the TR114 boards and how to change the parameters that are set in software.
Chapter 2	This chapter explains how to test your TR114 installation using Brooktrout's configuration and diagnostic software.
Appendix A	This hardware appendix describes the physical features of the TR114 uPCI series boards and recommends personal safety precautions when handling them. It describes pinouts and LED activity for Analog and BRI boards, and provides information for regulatory and standards compliance.
Appendix B	This appendix provides information about call progress error codes, result error codes, and ISDN cause codes.
Appendix C	This appendix describes the structure of the configuration files.
Appendix D	This appendix describes telephone service options. It provides order and connection information about Loop-start, DID, and ISDN services.
Glossary	The glossary defines the terms used in this manual.

Typographical Conventions

This manual uses the typographical conventions shown in the following table.

Convention	Type of Information
Italic typeface	File, path, directory or program name
`Bold monospace` typeface	Code or syntax entered by user
`Plain monospace` typeface	System output of code or syntax
Sans serif typeface	Keys or buttons to press, screen names

The Caution icon is used to indicate an action that could cause harm to the hardware or software.

The Warning icon is used to indicate an action that could cause harm to the user.

Related Documents

- The hardware installation guide that came with your board.
- TR114 Firmware Installation and Release Notes
- Brooktrout Fax and Voice API V4.3, User's Guide
- Bfv API Programmer's Reference Manual for TR114 and TruFax
- Bfv API and Driver Installation Guide for TR114

Documentation Feedback

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- Document number, located on the title page
- Release date, located on the title page
- Your telephone number if you would like us to contact you personally
- A brief description of your findings and the relevant location in the document

Your comments help us provide the highest quality documentation possible.

Introducing the TR114 Fax Board

The TR114 is a powerful fax and voice product that can be used for many applications, including fax broadcast, fax-on-demand, fax store and forward, LAN fax servers, e-mail to fax services, and combined voice and fax applications.

There are several types of TR114 PCI boards:

- The TR114 PCI loop-start analog boards

  These boards consist of one, two, and four-channel models for use in computers with PCI buses.
- The TR114 PCI two-channel and four-channel boards with DID interface

  These boards consist of two-channel and four-channel models and are used in computers with PCI buses for routing of calls on analog lines with DID service.
- The TR114 PCI combo boards

  These boards are a combination of the two and four channel DID and loop-start models.
- The TR114 Universal PCI boards for ISDN Basic Rate Interface (BRI).

  These boards consist of two-channel and four-channel models for use in computers with PCI buses.

This document includes information on configuring and testing your TR114 board, establishing telephone network connections, and troubleshooting any issues that might arise.

Because registry entries are for internal use only and can be changed without notice, defining configurations or processes based on the presence or order of registry entries is strongly discouraged.

For comprehensive information about features of the TR114 uPCI series boards, see Appendix A, *Hardware,* on page 27.

System Requirements

The following section describes:

- Hardware Requirements
- Operating Requirements
- Cable Requirements
- ISDN Requirements

Hardware Requirements

This section lists the required hardware for use with TR114 boards in your system.

- One 32- or 64-bit PCI slot
- A hardware interrupt (assigned by system BIOS)
- A block of consecutive I/O ports (assigned by system BIOS)
  - 12 addresses for two-channel boards
  - 20 addresses for four-channel boards
- Telephone service is required as follows:
  - For the TR114 uPCI Analog models, telephone service for loop-start telephone interface (analog single-line extension for PBX or Key telephone systems) or DID telephone service, or both.
  - For the TR114 PCI BRI model, ISDN telephone service. Appendix D, *Telephone Service Options*, on page 97 explains how to order telephone service.

Operating Requirements

This section summarizes the requirements for effective operation of TR114 boards in your system.

Temperature

0° - 50° C (32° - 122° F)

Humidity

10% - 95% (non-condensing)

Power

Note: The computer provides the power to the TR114 BRI; the TR114 BRI does not draw power from the NT1 or ISPBX.

Table 1 Power Requirements for Each TR114 Board (±5%)

Type	+5VDC	+12VDC	–12VDC
1-channel	1.08 A	4 mA	30 mA
2-channel	1.08 A	4 mA	30 mA
4-channel	1.09 A	6 mA	42 mA

Tellabs Model	Current Supplied	Current Used per Channel	DID Trunks Supported
8001	1.0 A	40 mA	25
8012	0.25 A	40 mA	6

Required Cables

Brooktrout supplies telephone cables with the TR114 board. If you make cables for your TR114, see *Telephone Jack Pinout* on page 34 for cabling information.

ISDN Requirements

The following summarizes the general requirements for ISDN installations.

Physical Requirements

- S/T BRI interface from an NT1 or ISPBX.
- Twisted-pair cable for the connection between the NT1 or ISPBX and the RJ-45 wall jack where the TR114 connects.

  Ask your NT1 or ISPBX vendor for specifications for this cable and the maximum length.
- 100-ohm termination at the RJ-45 wall jack if the connection to the NT1 is indirect.
- One ISDN BRI line for each TR114 ISDN / BRI interface – a P2B (two channel board) requires one line, a P4B (four channel board) requires two lines.

Data Link Requirements

Euro ISDN point-to-point (ptp) or point-to-multipoint (pmp).

Supplementary Services

If you have ISDN for a LAN fax network, you may need one or more circuit-switched supplementary services. Your ISDN service provider might provide these services with the BRI service. These services are described in more detail in *ISDN Supplementary Services* on page 122.

Inbound LAN Fax Subrouting

For inbound LAN fax subrouting, you need one of the following:

- Subaddressing (SUB)
- Direct Inward Dialing (DID)

Note: Digital terminology is Direct Dialing Inward (DDI).

- Multiple Subscriber Numbering (MSN)

Multiple Telephone Line Sharing

In order for multiple TR114 series boards to share a number of physical lines using the same telephone numbers, you might also need Multiple Access/Line Hunting (MA/LH).

Call Charge Information

To obtain call charge information, you need one of the following:

- Advice of Charge during the call (AOC-D)
- Advice of Charge at the end of the call (AOC-E)

For information on regulatory compliance, see *Regulatory Notices* on page 42.

Contacting Technical Support

Brooktrout provides technical support for customers who have purchased their TR114 board directly from Brooktrout Technology, Inc. If you purchased your TR114 board from a reseller, contact that reseller for technical support.

Getting Technical Support

If you contact Brooktrout Technical Support, please be prepared to work with the support personnel. You may be asked to do several things, such as taking down your server.

Please have the following information ready:

- The model of the TR114 board in question
- Test results obtained from running diagnostic software

Use one of the following methods to contact Brooktrout Technical Support.

United States, Canada, Latin America	Email: techsupport@brooktrout.com Fax: +1 781-449-9009 Technical support is available Monday through Friday, 8:30am through 5:30pm, Eastern US time.
Europe	Email: eurosupport@brooktrout.com Fax: +32 2-658-0180 Technical support is available Monday through Friday, 9:00am to 6:30pm CET.
Japan	Email: inu@dns1.infocom.co.jp Fax: +81 3-5800-9183 Technical support is available Monday through Friday, 9:30am to 5:30pm.
Web site	http://www.brooktrout.com

Returning a Defective TR114 Board

If you suspect that your TR114 board is malfunctioning, contact Brooktrout Technology or the reseller from whom you purchased the board.

Typically, Brooktrout Technical Support or your reseller requests that you run diagnostics on the TR114 board to determine whether it has a hardware defect. If it does, you need to return the board for repair to Brooktrout Technology, Inc. or to the reseller from whom you purchased it.

In the event of equipment malfunction, Brooktrout Technology, Inc. or an authorized agent should perform all repairs. The user is responsible for reporting the need for service to Brooktrout or to one of its authorized agents.

When returning a product on Return Merchandise Authorization (RMA) to Brooktrout Technology, Inc., ship it in the original packaging or in an antistatic bag within a guarded box so that the board is not damaged in the shipping process. Write the RMA number on the shipping container and send the container to the following address:

Brooktrout Technology, Inc.
18 Keewaydin Drive
Salem, New Hampshire 03079
USA

1 Configuring Your TR114 Board

This chapter explains how to configure the TR114 boards, and how to change the parameters that are set in software.

Before configuring your board, install your TR114 and connect your phone service to it following the instructions in the hardware installation guide included with the board.

For information about connecting your telephone service, see Appendix D, *Telephone Service Options,* on page 97.

This chapter includes the following activities for setting up Brooktrout firmware, software, and configuration files:

- Setting up Firmware, Software, and Configuration Files
- Ensuring that the Board is Working

Setting up Firmware, Software, and Configuration Files

The following sections explain how to install Brooktrout Firmware and set up LAN Fax driver parameters, driver, and configuration files.

Installing Brooktrout Firmware Files

The TR114 firmware is included on a CD-ROM. See the *TR114 Firmware Installation and Release Notes* for detailed instructions on how to copy the contents of the media onto your hard drive and how to download the firmware to the TR114.

If you use the TR114 with LAN fax server applications, refer to the documentation accompanying the application software. In most cases, the firmware is already included with the software you received from the LAN fax software vendor and no further installation is required.

Setting Brooktrout Driver Parameters

Brooktrout does not provide a driver with the board. Your Lan Fax application and the Brooktrout test application both include a Brooktrout driver (*bfax.sys*). During the installation of a test or fax application, the software installs this driver. The software might request a Direct Memory Access (DMA) channel or interrupt value. Specify "`-1`" for each of your TR114 uPCI boards. Select the default value for any other requested driver parameter.

Loading the Driver and Initializing the TR114

The Brooktrout *bfax* driver starts when you start up your computer. You can start it manually by entering the following at a DOS prompt:

```
net start bfax
```

After the driver has been started automatically at boot time, the initialization service (faxinit.exe) runs automatically or, to run it manually:

1. In a DOS window move to the directory where *faxinit.exe* resides
2. Enter the following at the DOS prompt:

```
faxinit -n
```

This command displays the number of channels installed in your computer and, in the case of the TR114 BRI, the BRI firmware version number.

Configuring ISDN (for TR114 BRI Only)

The TR114 BRI boards (P2B and P4B) are configured with a default ISDN environment. The default data link is point-to-multipoint; the default bearer capability is 3.1k Audio.

If your environment differs from the default, run the ISDN BRI configuration utility (*briconf*) to change the ISDN configuration. For example, DID (DDI) supplementary service is usually provided on a point-to-point data link. The TR114 default is point-to-multipoint, so you would have to change the configuration to point-to-point.

Edit and run the *bri.cnf* file to change the ISDN configuration. Refer to *BRI Configuration Utility* on page 88 for a detailed description of the *briconf* utility and the ISDN parameters.

The default data link is point-to-multipoint; the default bearer capability is 3.1K Audio. If you need to change the data link or bearer capability, use the following procedures:

1. Edit the `datalink` or `bearer` keyword in the *bri.cnf* file and enter the other value.
2. Run the *briconf* utility to change those settings on the TR114 ISDN, as follows:

   `briconf -p bri.cnf`

The following provide examples of BRI configuration (*bri.cfg*) files:

Example 1 Datalink set to Point-to-point with Bearer set to 31K Audio

```
datalink=ptp
bearer=31k audio

01xxxxx3
11xxxxx3
21xxxxx3
31xxxxx3
```

Example 2 Datalink set to Point-to-multipoint with Bearer set to Speech

```
datalink=pmp
bearer=speech

02xxxxx3
12xxxxx3
22xxxxx3
32xxxxx3
```

Note: The final number has not been implemented, so your application ignores any value entered there.

If the *isdn.cfg* file is included in the software, you can set some ISDN parameters, excluding the datalink, in the *isdn.cfg* file, which has priority over the **`briconf -p bri.cnf`** configuration.

The following provide examples of ISDN configuration (*isdn.cfg*) files for the TR114 BRI board with four channels:

Example 3 Bearer set to 31K Audio

```
bearer=31k audio

01xxxxx3
11xxxxx3
21xxxxx3
31xxxxx3
```

Example 4 Bearer set to Speech

```
bearer=speech

02xxxxx3
12xxxxx3
22xxxxx3
32xxxxx3
```

Note: The final number has not been implemented, so your application ignores any value entered there.

Refer to *ISDN Configuration File* on page 85 for a detailed description of all of the *isdn.cfg* values.

Your board should now be configured correctly. Proceed to the next section to configure the LAN Fax software and test your installation.

For more information about ISDN installations, see *ISDN Telephone Service* on page 107.

Configuring Your LAN Fax Software

See your LAN fax application's user manual for instructions on configuring your LAN fax software. The LAN Fax software comes with the Brooktrout driver. After you have set up your LAN fax software to support the TR114, you can begin sending and receiving faxes using that software.

You might need to edit the following parameters in the *btcall.cfg* file in order to run your software:

- Country code
- DID variable and DID digits

Note: If you are testing the board using the Brooktrout test software, the file *user.cfg* is the same file as *btcall.cfg* in the API and your software. For more information, see *User-Defined Configuration File* on page 73. The *btcall.cfg* file requires the same parameter settings as the *user.cfg* file.

The following sections explain how to change these parameters.

Setting the Country Code

If the system contains only BRI boards, leave the `country_code` parameter set to the default, 0010. If the system contains both analog and BRI boards, set the `country_code` parameter to match the setting for the analog board.

Setting the DID Digits and DID Variable

Set the *did_digits* parameter to the total number of digits that you expect to receive; this works in all circumstances. The default settings for the TR114 DID/C usually work. For TR114 BRI boards, you might want to set the *did_digits* parameter to 0 as your default if the total number of digits that you expect to receive has yet to be determined.

If you expect to receive a variable number of digits, the following sections explain how to set DID digits.

The exact setting of the *did_digits* parameter depends on whether the card receives DID digits en-block or overlapped.

En-block

When sending digits using the en-block method, the application passes the whole number in a single group. Most installations receive DID digits in this way.

If you receive DID digits en-block, set the *did_digits* parameter to the expected number of digits and the *did_variable* parameter to 0. Setting *did_digits* to a value less than the expected number of DID digits causes only the trailing digits to be passed. For example, if the network sends 1234567 as the called party number and *did_digits* is set to 3, the board returns 567 to the application. Setting *did_digits* to a value greater than the number of digits you receive causes the TR114 board to reject the call.

Overlapped Receiving

When sending digits using the overlapped receiving method, the application passes the DID digits grouped into separate messages. Overlapped receiving is found in the following circumstances:

- When the public network in some countries, notably Germany, Austria, and Italy, allows a user-defined variable number of subaddress DID digits.
- When the supplemental service is DID and the data link is point-to-point.
- When the caller is dialing using overlapped sending.

If you receive DID digits in overlapped receiving mode and the number of digits you might receive are variable, set the *did_digits* parameter to the maximum you expect to receive and set the *did_variable* parameter to 1. When the *did_variable* parameter is set to 1, the board operates with a 5-second interdigit timeout.

Ensuring that the Board is Working

Brooktrout strongly recommends that you test your TR114 board after you install it. There are two ways to test the board:

- If you are installing Brooktrout software and writing your own application, successfully running the sample application verifies your board is working correctly.

  Refer to the *Bfv API and Driver Installation Guide* for TR114, V4.3 and *TR114 Firmware and Release Notes* for information on installing the Brooktrout software and firmware.
- If you plan to install software from another vendor, first run the Brooktrout *testnt* program to test the board installation. This process is explained in *Chapter 2, Testing.*

2 Testing

This chapter explains how to test your TR114 installation using Brooktrout's configuration and diagnostic software. You can download a copy of the test program from the Brooktrout web site. For information about downloading the test program or other software, see *Downloading Software from the Brooktrout Web Site* on page 10.

Use the windows-based test program *(testnt)* to test up to 2 channels simultaneously on one or more Brooktrout boards in a Windows NT server.

- Introduction to Testing
- LED Activity
- Using testnt to Test Your Installation
- Troubleshooting Under Windows NT/2000
- Uninstalling the Test Driver

Introduction to Testing

If you are using LAN fax software, you can test the board using test software from the LAN fax vendor instead of *testnt*. See the manual shipped with your LAN fax software for more information.

For information about running a BRI ISDN trace, see *Capturing Trace Information* on page 96.

No other application, including the LAN fax application, should be running in your system. Also, after you have run the *testnt* program, you might have to reboot and re-install the driver that comes with your LAN fax application.

Downloading Software from the Brooktrout Web Site

You can obtain the latest firmware and *testnt* software from the Brooktrout web site. To download either the firmware or software, go to the Brooktrout web site at http://www.brooktrout.com and do the following:

1. Place your mouse arrow over Support on the Brooktrout web site menu options to see your product, the TR114.
2. Place your mouse arrow over TR114 to see your board model.
3. Select your board model.
4. Select Download to see the list of available items.
5. Select the appropriate item, then follow the instructions to save the file.
6. Download the test to the new directory.
7. Open a DOS window and change to the new directory.
8. Type the command:

   `ntdiag`

   to extract the files listed in the following table.

Files Required

All of the following files must be present for *testnt.exe* to work properly.

Table 2 Files Required for *testnt*

File Name	Description
bfax.sys	The Brooktrout driver
ccode.txt	A text file containing the supported country codes
country.cfg	A read-only configuration file with country-specific information
digital.cfg	A configuration file used by *testnt* containing configuration information that sets general operation parameters for the digital TR114, (TR114 MVIP, TR114 SC), not covered in this manual
faxcfg.exe	A program used by *testnt* to create a configuration file for *faxinit*
faxinit.exe	The utility program that *testnt* uses to initialize and find the PCI boards
ibmpcps.fz8	The font file containing the normal resolution Pica standard font set
isdn.cfg	A file containing ISDN parameters for TR114 BRI boards only
msg.txt	A text file for messages from *testnt*
ntinstal.exe	A program that *testnt* used to install the *bfax* driver
readme.txt	A text file explaining how to run *testnt*
results.txt	A file in which *testnt* writes information on port reset status for a digital board, not covered in this manual
runfaxin.exe	A program that runs *faxinit*
session.txt	A text file describing a *testnt* session
test-164.pex	Test firmware that the *testnt.exe* program automatically downloads to the TR114 (not applicable for TruFax)
test.ips	A test file from which a fax is sent
testnt.exe	A Windows NT test program used to send and receive facsimiles
user.cfg	The user-defined configuration file that contains a number of run-time configuration parameters (See *User-Defined Configuration File on page 73* for details.)
briconf.exe	A utility to configure TR114 BRI boards

LED Activity

The red LEDs indicate the activity of their associated TR114 channels. They each:

- Flash once when the computer is powered up.
- Flash rapidly while the firmware is being downloaded to the board.
- Turn solid red when the channel goes off hook.
- Turn off when the channel goes on hook.
- Flash periodically whether on or off hook to indicate that the channel is alive.

See *Monitoring LED Activity* on page 36 for more information about understanding LED signals.

Using *testnt* to Test Your Installation

Testnt uses the Brooktrout fax driver running under Windows NT and Windows 2000. The driver is called *bfax* and is included in the test directory. *Testnt* also includes the *faxinit* utility. The *faxinit* utility tries to find every channel on every board and associates each channel with a port number starting at 0.

If your present fax application does not use *bfax*, make certain that no drivers or services under Windows NT/2000 that normally use Brooktrout fax boards are running before you run *testnt*.

If you have a TR114 BRI board, edit the file *user.cfg* to configure the value of *did_digits* and `did_variable` according to the number of digits you receive in the incoming ISDN Called Party Number. This must be done to successfully receive faxes. See *Setting the DID Digits and DID Variable* on page 6 for more information on setting values for the TR114 board.

Running *testnt*

To run *testnt*:

1. Open an MS-DOS Window.
2. Go to the *faxtestnt* directory:

   `cd \dirname`

   where *dirname* is the directory storing the downloaded and extracted test files.
3. Run *testnt* by entering the following:

   `start testnt`

A window appears with *testnt* running in it. You might need to resize the window in order to view all of the information.

When *testnt* is started, the software tries to locate *bfax* and the channels on each Brooktrout fax board. If *bfax* is up and running, the Channel Overview screen appears as described in *Using the Channel Overview Screen* on page 17.

If *bfax* is not already installed or is different from a running version of the driver, the following message appears within the *testnt* window:

TR Series Hardware Test for Windows NT
Brooktrout Fax Driver
This application requires Brooktrout Fax Driver 4.0.0 be installed an running on the system for use. This driver either is not present or is not loaded correctly.
Click OK to install Brooktrout Fax Driver or Click CANCEL to exit.
< OK >
< CANCEL >

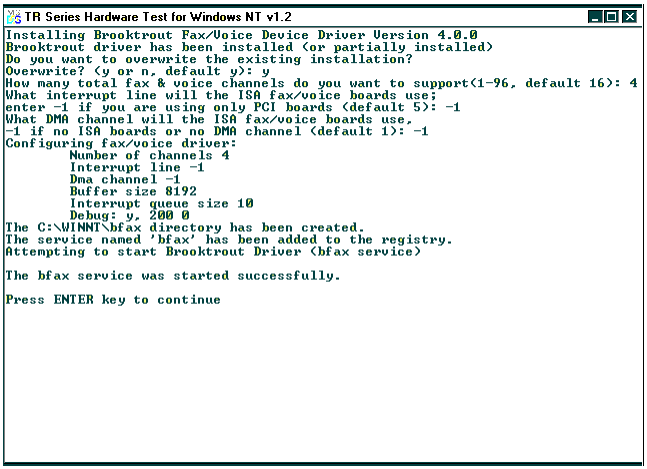
Click the appropriate button. For the buttons listed on the bottom of any window, a single mouse click activates the button. However, on Windows 2000, you might have to change the mouse properties. “QuickEdit Mode” and “Insert Mode” should be disabled.

To change mouse properties:

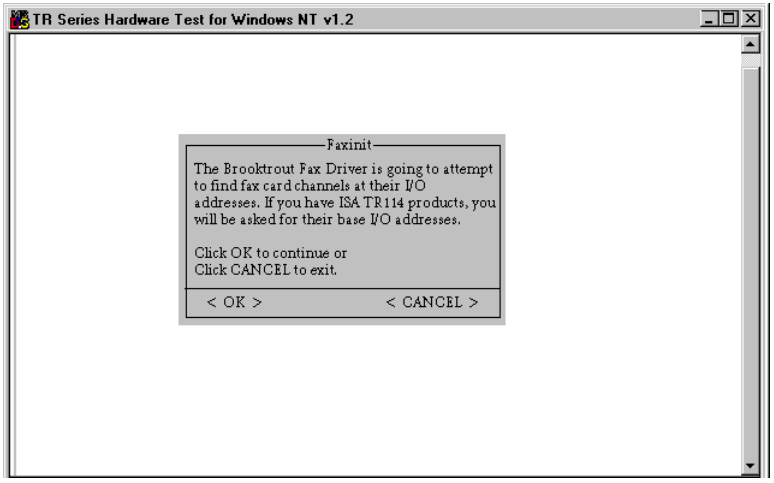
- Position the mouse arrow on the blue line at the top of the test window.
- Right click.

When you continue, *testnt* installs the *bfax* driver and queries you about your configuration as shown in the following screen.

(The following is a single 4-channel PCI board example.)

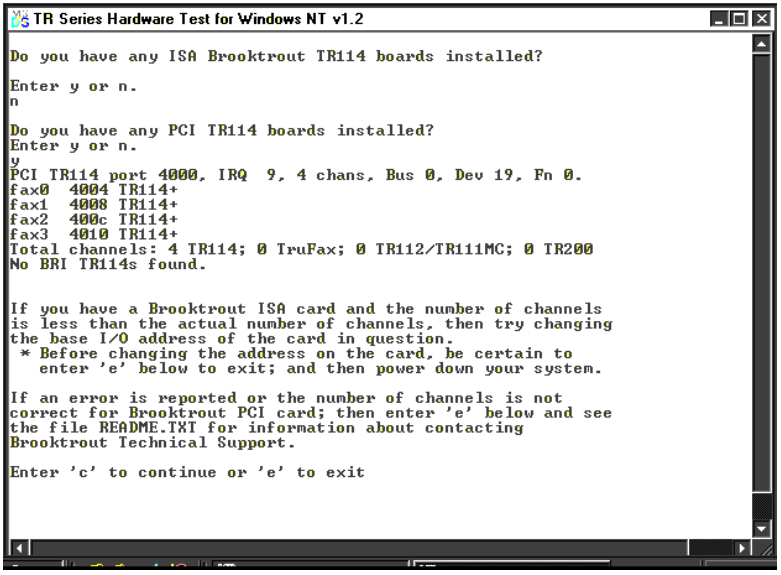

TR Series Hardware Test for Windows NT v1.2
Installing Brooktrout Fax/Voice Device Driver Version 4.0.0
Brooktrout driver has been installed (or partially installed)
Do you want to overwrite the existing installation?
Overwrite? (y or n, default y): y
How many total fax & voice channels do you want to support(1-96, default 16): 4
What interrupt line will the ISA fax/voice boards use;
enter -1 if you are using only PCI boards (default 5): -1
What DMA channel will the ISA fax/voice boards use,
-1 if no ISA boards or no DMA channel (default 1): -1
Configuring fax/voice driver:
Number of channels 4
Interrupt line -1
Dma channel -1
Buffer size 8192
Interrupt queue size 10
Debug: y, 200 0
The C:\WINNT\bfax directory has been created.
The service named 'bfax' has been added to the registry.
Attempting to start Brooktrout Driver (bfax service)
The bfax service was started successfully.
Press ENTER key to continue

After you enter this information the *testnt* program starts *bfax*. When you press Enter to continue, *testnt* starts *faxinit* as shown in the next window.


TR Series Hardware Test for Windows NT v1.2
Faxinit
The Brooktrout Fax Driver is going to attempt to find fax card channels at their I/O addresses. If you have ISA TR114 products, you will be asked for their base I/O addresses.
Click OK to continue or
Click CANCEL to exit.
< OK >
< CANCEL >

Select OK to continue.

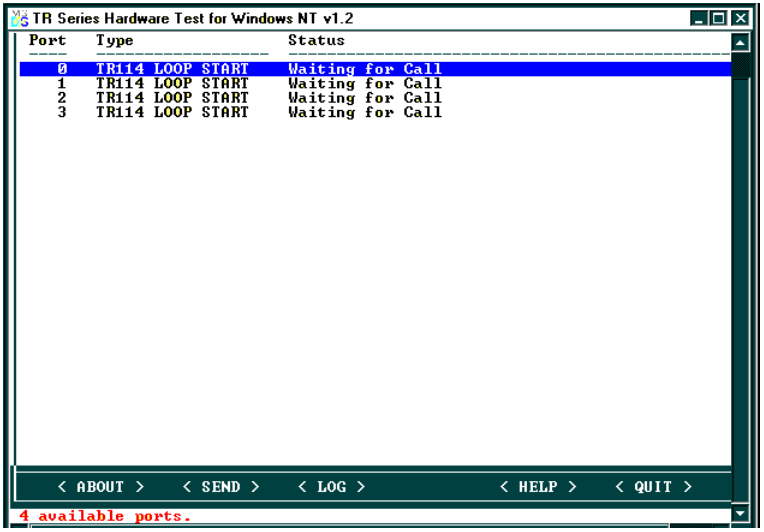
The following is a single 4-channel PCI board example.


TR Series Hardware Test for Windows NT v1.2
Do you have any ISA Brooktrout TR114 boards installed?
Enter y or n.
n
Do you have any PCI TR114 boards installed?
Enter y or n.
y
PCI TR114 port 4000, IRQ 9, 4 chans, Bus 0, Dev 19, Fn 0.
fax0 4004 TR114+
fax1 4008 TR114+
fax2 400c TR114+
fax3 4010 TR114+
Total channels: 4 TR114; 0 TruFax; 0 TR112/TR111MC; 0 TR200
No BRI TR114s found.
If you have a Brooktrout ISA card and the number of channels
is less than the actual number of channels, then try changing
the base I/O address of the card in question.
* Before changing the address on the card, be certain to
enter 'e' below to exit; and then power down your system.
If an error is reported or the number of channels is not
correct for Brooktrout PCI card; then enter 'e' below and see
the file README.TXT for information about contacting
Brooktrout Technical Support.
Enter 'c' to continue or 'e' to exit

After you answer the question about the kind of Brooktrout boards you have, the software runs *faxinit* and displays the output. If no errors are reported and the correct number of channels is reported, type C and press Enter to continue. The Channel Overview screen appears.

Using the Channel Overview Screen

The Channel Overview screen lists each port and its status.



If you are installing a TR114 BRI board and your line is not using the Brooktrout default datalink (point-to-multipoint) setting, you need to have run the *briconf.exe* program. If you have not, select <QUIT> and run the *briconf* utility. You should have a *briconf* text file with the ISDN parameters (such as the datalink) that you need.

- For examples of the text files, see *Example 1* on page 4.
- For details about running the *briconf* utility (`briconf -p bri.cnf`) see *BRI Configuration Utility* on page 88.
- For a detailed description of ISDN parameters, see Table 20 on page 93.

After creating the configuration, run *testnt* again.

About

Select <ABOUT> to show the version information of *bfax* and a description of how to contact Brooktrout Technical Support.

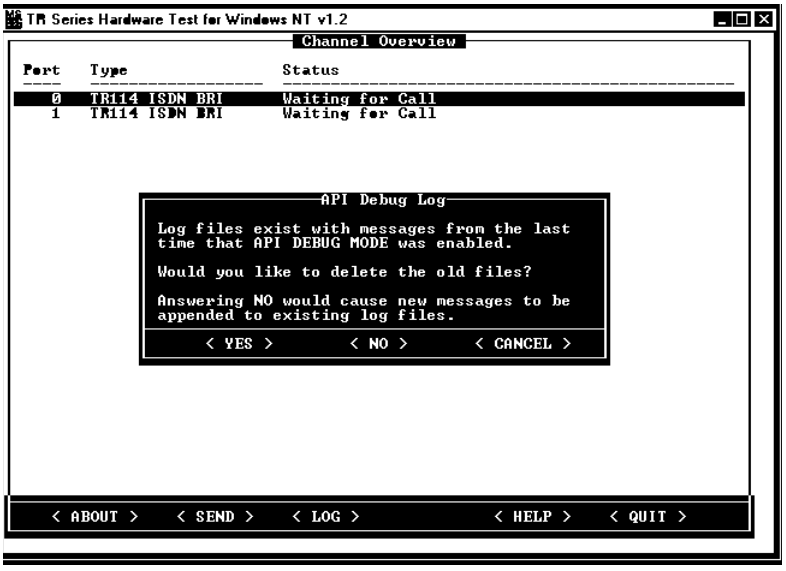
Send

Select <SEND> to send the fax.

Log

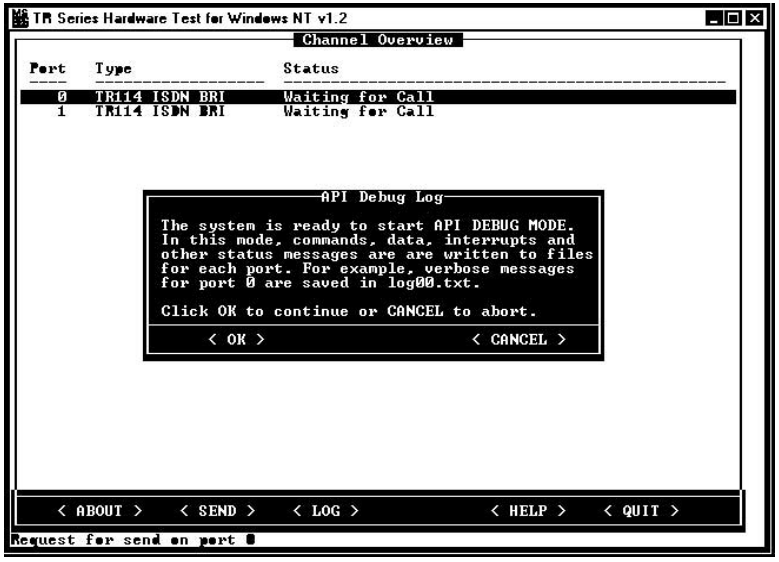
Select <LOG> to create a log file that records the send/receive activities for each channel used. If you have problems sending and receiving faxes, click the <LOG> button before using the channel. Logs are created for each fax sent or received until the <LOG> button is clicked again. Look for the logs as *logxx.txt* files in your fax test directory (see *cd \dirname* on page 13). The screens on the following pages are Log screens. To disable the <LOG> command, click <LOG> again.

Beginning log screen

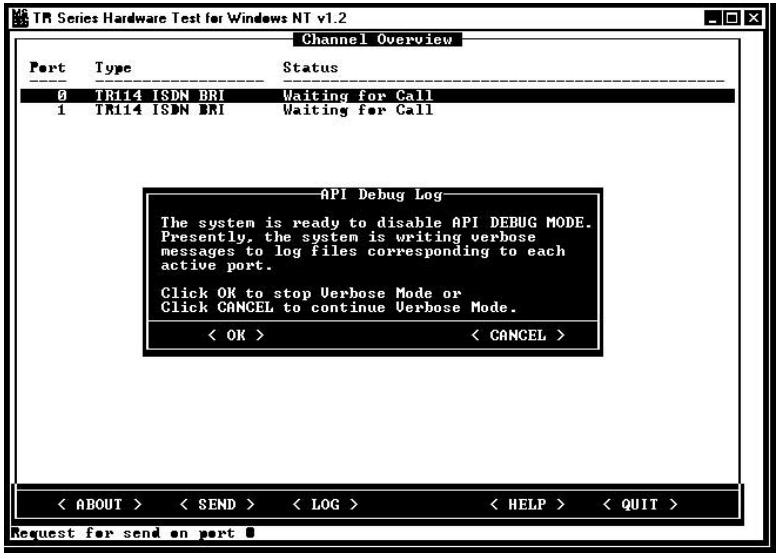


The Beginning log screen appears when you have previously captured log files.

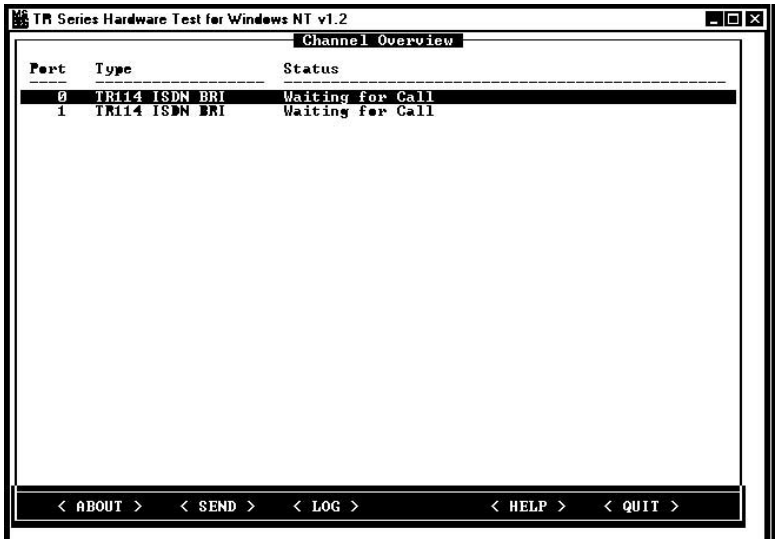
Screen display for starting debug mode


TR Series Hardware Test for Windows NT v1.2
Channel Overview
Port Type Status
0 TR114 ISDN BRI Waiting for Call
1 TR114 ISDN BRI Waiting for Call
API Debug Log
The system is ready to start API DEBUG MODE.
In this mode, commands, data, interrupts and
other status messages are are written to files
for each port. For example, verbose messages
for port 0 are saved in log00.txt.
Click OK to continue or CANCEL to abort.
< OK >
< CANCEL >
< ABOUT > < SEND > < LOG > < HELP > < QUIT >
Request for send on port 0

Screen display to disable debug mode


TR Series Hardware Test for Windows NT v1.2
Channel Overview
Port Type Status
0 TR114 ISDN BRI Waiting for Call
1 TR114 ISDN BRI Waiting for Call
API Debug Log
The system is ready to disable API DEBUG MODE.
Presently, the system is writing verbose
messages to log files corresponding to each
active port.
Click OK to stop Verbose Mode or
Click CANCEL to continue Verbose Mode.
< OK >
< CANCEL >
< ABOUT > < SEND > < LOG > < HELP > < QUIT >
Request for send on port 0

Screen display for an idle system



In addition to capturing the API debug log for each channel in a *logxx.txt* file, you can use the *briconf* program to perform on-card protocol analysis. The *briconf* utility captures the trace information to the circular buffer. Press <QUIT> on the *testnt* Channel Overview screen to display the DOS window.

1. To start the trace, enter the following at the DOS prompt:
   `briconf -d c`
2. Rerun the *NTTest* program as follows:
   `nttest`
3. Send or receive faxes using the *NTTest* program.
4. When you finish sending and receiving faxes, select <QUIT> to exit the screen.
5. Send the contents to the *britrace.txt* file as follows:
   `briconf -d e`

The *briconf* utility automatically creates the *britrace.txt* file in the same directory. Technical Support engineers use the *britrace.txt* and *logxx.txt* files when diagnosing problems.

Help

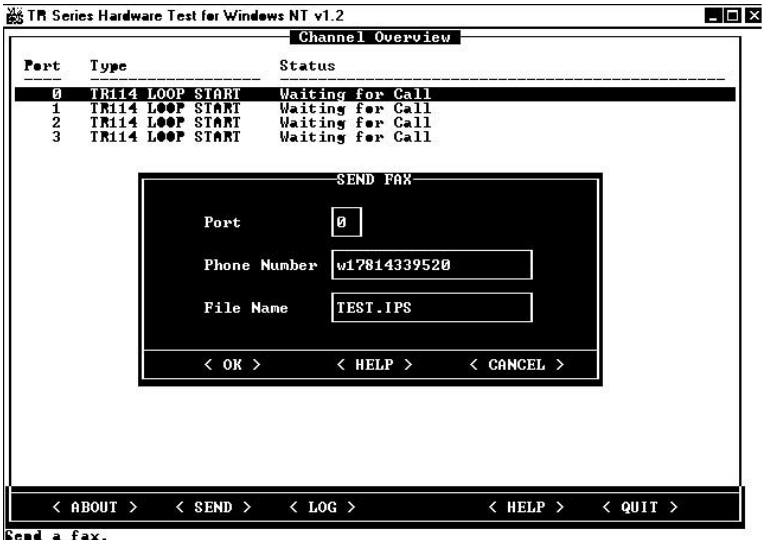
Select <HELP> to see additional information about what you can do in the Channel Overview screen.

Quit

Select <QUIT> to close the test utility.

Sending a Fax

If you select <SEND>, the following window appears:



1. Enter the port (channel) number you wish to use.
2. Use the Tab key to move to the next field and enter the phone number of a local fax machine.

   Enter one of the following values in front of the telephone number if you need to have the channel wait for a dial tone or a timed delay (loop-start only) before it dials the number.

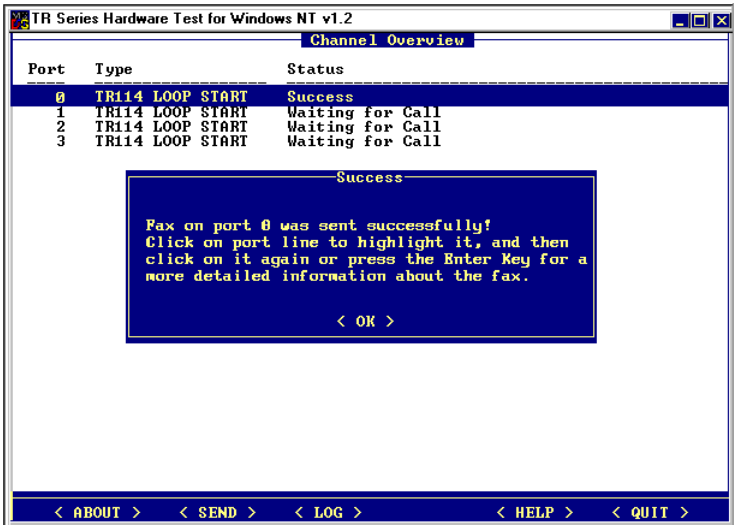
Value	Definition
w	Wait for dial tone
, (comma)	1 second pause
; (semicolon)	5 second pause

3. Select <OK> to send the fax.

Note: You can also use the mouse to reposition the cursor on any of the fields to make changes.

The Status messages of the port in question change and these messages report the progress of the send activity.

If the fax goes through correctly, the following window appears:


TR Series Hardware Test for Windows NT v1.2
Channel Overview
Port Type Status
0 TR114 LOOP START Success
1 TR114 LOOP START Waiting for Call
2 TR114 LOOP START Waiting for Call
3 TR114 LOOP START Waiting for Call
Success
Fax on port 0 was sent successfully!
Click on port line to highlight it, and then
click on it again or press the Enter Key for a
more detailed information about the fax.
< OK >
< ABOUT > < SEND > < LOG > < HELP > < QUIT >

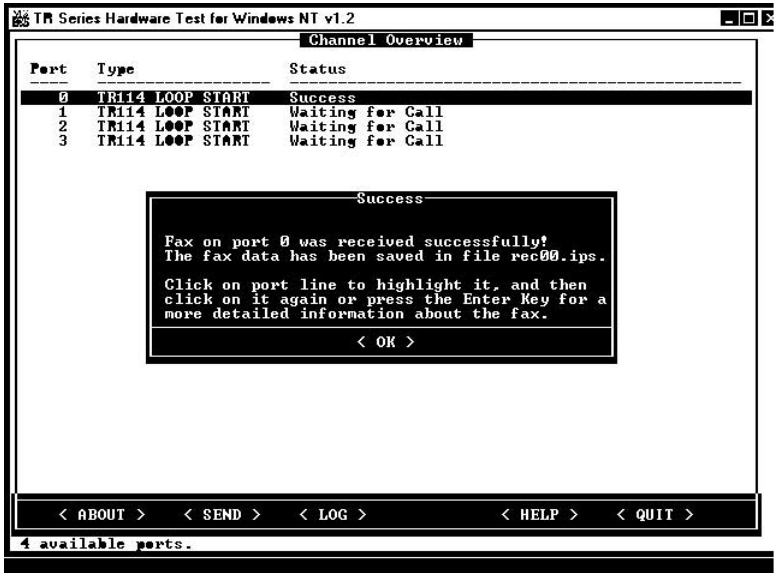
4. Select <OK>, then highlight the line that lists the port number you want to examine further.
5. Select that line again or press Enter to display the Status History screen.

Receiving a Fax

If a port is in the Waiting for Call state, it is ready to receive a fax.

1. From a local fax machine, dial the phone number corresponding to the port.

   Once the call is detected, the port picks up and starts to receive the fax automatically. After the fax is received, it is saved in a file and the following window appears:


TR Series Hardware Test for Windows NT v1.2
Channel Overview
Port Type Status
0 TR114 LOOP START Success
1 TR114 LOOP START Waiting for Call
2 TR114 LOOP START Waiting for Call
3 TR114 LOOP START Waiting for Call
Success
Fax on port 0 was received successfully!
The fax data has been saved in file rec00.ips.
Click on port line to highlight it, and then click on it again or press the Enter Key for a more detailed information about the fax.
< OK >
< ABOUT > < SEND > < LOG > < HELP > < QUIT >
4 available ports.

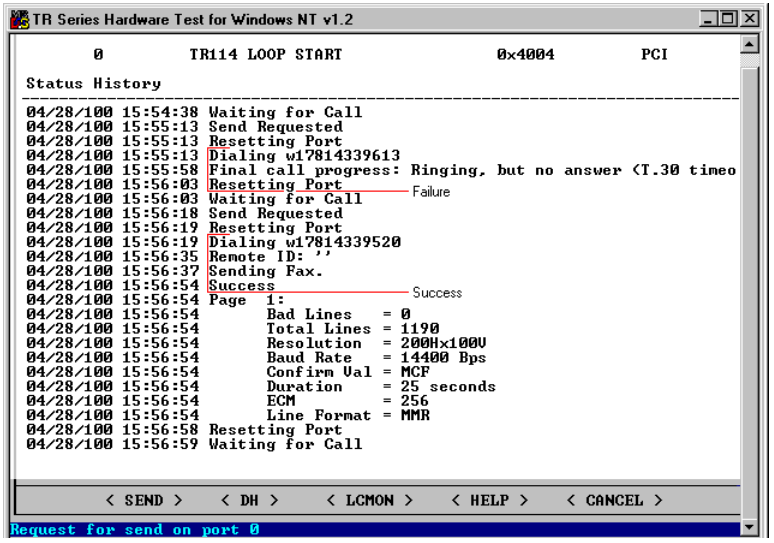
The port is not ready for the next call until you select <OK>.

2. After you select <OK>, highlight the line that lists the port number, then select that line again or press Enter to display the Status History screen where you can see detailed information about the port.
3. At this point, to send the fax back out to a local fax machine, select <SEND> and then enter the name of the file that was received (in this example it would be *rec00.ips)*.

Status History Screen

The Status History screen displays detailed information about a particular port. It also displays past status messages. When a fax is sent or received on the port, the messages are updated automatically.

The following image shows a failed attempt to send a fax, and then, a successful attempt (single page using a PCI board).


TR Series Hardware Test for Windows NT v1.2
0 TR114 LOOP START 0x4004 PCI
Status History
04/28/100 15:54:38 Waiting for Call
04/28/100 15:55:13 Send Requested
04/28/100 15:55:13 Resetting Port
04/28/100 15:55:13 Dialing w17814339613
04/28/100 15:55:58 Final call progress: Ringing, but no answer (T.30 timeo
04/28/100 15:56:03 Resetting Port
Failure
04/28/100 15:56:03 Waiting for Call
04/28/100 15:56:18 Send Requested
04/28/100 15:56:19 Resetting Port
04/28/100 15:56:19 Dialing w17814339520
04/28/100 15:56:35 Remote ID: ''
04/28/100 15:56:37 Sending Fax.
04/28/100 15:56:54 Success
Success
04/28/100 15:56:54 Page 1:
04/28/100 15:56:54 Bad Lines = 0
04/28/100 15:56:54 Total Lines = 1190
04/28/100 15:56:54 Resolution = 200Hx100V
04/28/100 15:56:54 Baud Rate = 14400 Bps
04/28/100 15:56:54 Confirm Val = MCF
04/28/100 15:56:54 Duration = 25 seconds
04/28/100 15:56:54 ECM = 256
04/28/100 15:56:54 Line Format = MMR
04/28/100 15:56:58 Resetting Port
04/28/100 15:56:59 Waiting for Call
< SEND > < DH > < LCMON > < HELP > < CANCEL >
Request for send on port 0

Send The <SEND> option lets you send the fax again.

Help The <HELP> option provides further information about what you can do in the Status History screen.

Cancel Select the <CANCEL> option (or the Esc key) to return to the Channel Overview screen.

DH The <DH> option is for capturing the dump history, which should be done only when requested by Brooktrout Technical Support.

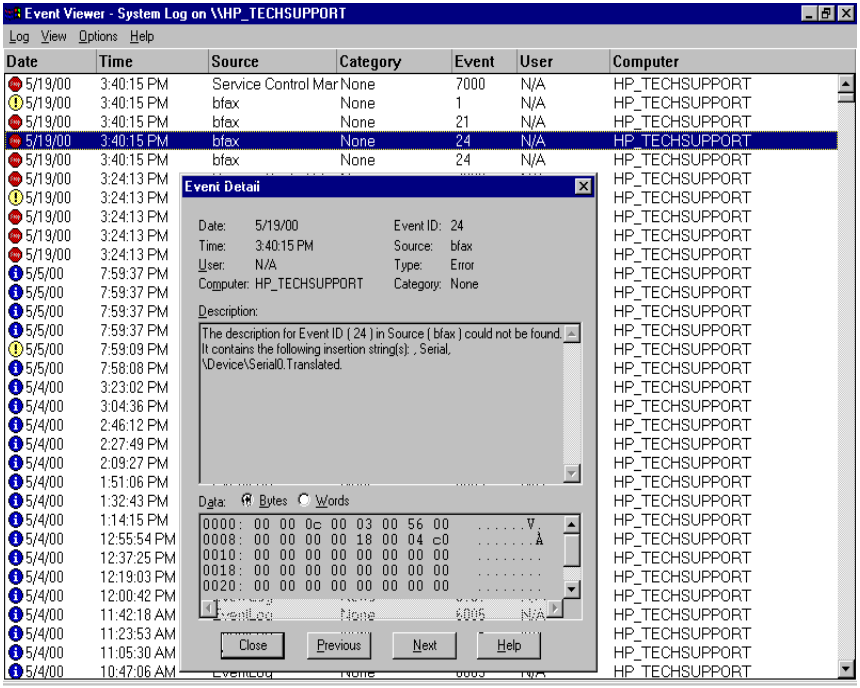
LCMON Use the <LCMON> option to disable or enable loop current monitoring (for T1, it enables or disables answer supervision or signaling). Only use the <LCMON> option if requested by Brooktrout Technical Support.

Troubleshooting Under Windows NT/2000

If *testnt* encounters an error, it displays a message in the window where the error occurred.

If a system error occurs, you can find the exact cause of the error in the Event Viewer.

For example, if you receive the system error 487 in the window where you load *bfax*, it means that the driver did not install due to an error. Look in the Event Viewer for *bfax* to find the description of the error. For example:


Event Viewer - System Log on \\HP_TECHSUPPORT
Log View Options Help
Date Time Source Category Event User Computer
5/19/00 3:40:15 PM Service Control Mar None 7000 N/A HP_TECHSUPPORT
5/19/00 3:40:15 PM bfax None 1 N/A HP_TECHSUPPORT
5/19/00 3:40:15 PM bfax None 21 N/A HP_TECHSUPPORT
5/19/00 3:40:15 PM bfax None 24 N/A HP_TECHSUPPORT
5/19/00 3:40:15 PM bfax None 24 N/A HP_TECHSUPPORT
Event Detail
Date: 5/19/00
Time: 3:40:15 PM
User: N/A
Computer: HP_TECHSUPPORT
Event ID: 24
Source: bfax
Type: Error
Category: None
Description:
The description for Event ID (24) in Source (bfax) could not be found.
It contains the following insertion string(s): , Serial,
\Device\Serial0.Translated.
Data: Bytes Words
0000: 00 00 0c 00 03 00 56 00
0008: 00 00 00 00 18 00 04 c0
0010: 00 00 00 00 00 00 00 00
0018: 00 00 00 00 00 00 00 00
0020: 00 00 00 00 00 00 00 00
Close
Previous
Next
Help

Error 487 usually means that an error was caused by some kind of hardware conflict, in this case an interrupt conflict. For a PCI board, enter –1 instead of an IRQ number. Otherwise, you could have a conflict with another driver.

Uninstalling the Test Driver

If *testnt* installs *bfax*, then you must uninstall it from a DOS window by entering the following commands:

```
net stop bfax
ntinstal -r
```

If you fail to uninstall *bfax.sys*, a system crash might occur because two different drivers are trying to access the same resource.

After you have run the testnt program, you might have to reboot and re-install the driver that comes with your LAN fax application.

A Hardware

This hardware appendix describes the physical features of the TR114 uPCI series boards and recommends personal safety cautions when handling them. It describes pinouts and LED activity, and provides information for regulatory and standards compliance.

It includes the following sections:

- TR114 Models
- TR114 Features
- Notices Regarding Personal Safety
- Telephone Jack Pinout
- Monitoring LED Activity
- Regulatory Notices

TR114 Models

The following table summarizes the TR114 universal PCI boards, their number and type of channels, and their availability. Each model can use the same type and number of telephone lines as interfaces on the board.

Table 3 TR114 Models

Board Type	# Channels	Type of Channels	Available in US?	Available Outside US?
TR114+uP1L	1	loop-start	N	Y
TR114+uP2L	2	loop-start	Y	Y
TR114+uP4L	4	loop-start	Y	Y
TR114+uP2D	2	DDI	Y	N
TR114+uP4D	4	DDI	Y	N
TR114+uP2C	2	1 loop-start, 1 DDI	Y	N
TR114+uP4C	4	2 loop-start, 2 DDI	Y	N
TR114+uP2B	2	1BRI	N	Y
TR114+uP4B	4	2BRI	N	Y

TR114 Features

The features of the TR114 board include high-performance fax and voice capabilities.

Table 4 Features of the TR114 Boards

Feature	BRI	Analog DID	Loop-start
One, two, or four independent fax and/or voice channels in one 32-bit PCI bus slot or 64-bit universal PCI bus slot	Yes 2, 4 channels available	Yes 2, 4 channels available	Yes 1 channel available
Integrated onboard BRI interfaces that eliminate the need for separate interface devices	Yes	No	No
Support for obtaining call charge information using the ISDN Advice-of-Charge service	Yes	No	No
Full Group 3 fax send-and-receive functionality on each channel, with advanced features such as Error Correction Mode, Binary File Transfer, and MH, MR, or MMR compression	Yes	Yes	Yes
Speech record and playback	Yes	Yes	Yes
Each channel can record and play back ADPCM and PCM, permitting you to build a variety of fax and voice systems – such as voice-prompted fax retrieval systems, fax mail systems with voice annotation capability, and integrated voice/fax mail systems – using a single TR114	Yes	Yes	Yes
DTMF (Touch Tone), SIT, CNG, and CED detection capability	Yes	Yes	Yes
Auto conversion of ASCII, MH, MR, MMR, TIFF, and PCX/DCX files	Yes	Yes	Yes
Onboard forms overlay capability (increases efficiency and throughput of high-volume forms-based fax applications)	Yes	Yes	Yes
Automatic reduction or expansion of the page width on transmission	Yes	Yes	Yes
Adaptive in-band and out-of-band call progress detection capability that works globally	Yes	Yes	Yes

Table 4 Features of the TR114 Boards (Continued)

Feature	BRI	Analog DID	Loop-start
Downloadable firmware for new functionality (updates are easily installed, even in the field, from a disk medium or from the Brooktrout web site)	Yes	Yes	Yes
Programmed I/O (PIO) data transfer capability for efficient, multichannel support	Yes	Yes	Yes
LED status indicators	Yes	Yes	Yes
Application Programming Interface libraries and drivers for a number of operating systems (see the *Brooktrout Fax and Voice Application Programming Interface User's Guide)*	Yes	Yes	Yes

Notices Regarding Personal Safety

The following safety information is important when installing a TR114 board in a personal computer.

Safety considerations for protection of personnel from voltages on the telephone lines

The analog telecommunications interface is intended to be connected to telecommunications network voltage (TNV) circuits that might carry dangerous voltages. The telephone cord(s) must remain disconnected from the telecommunications system until the board has been installed within a host that provides the necessary protection of the operator.

If you must open the host equipment for any reason, disconnect the telephone cord(s) prior to touching any internal parts that might carry telecommunications voltages.

Safety considerations for protecting the telephone lines from host-generated or resident voltages

The power required by the host and the total of all adapter boards installed within the host environment, together with any auxiliary apparatus, shall not exceed the power specification of the host apparatus.

For TR114 power requirements, see *Power* on page xv.

It is essential that you maintain the minimum creepages and clearances specified in the table below when you install other option boards that use or generate a hazardous voltage. A hazardous voltage is one that exceeds 42.4 Vac peak or 60 Vdc. If you have any doubt, seek advice from a competent engineer before installing other adapters into the host equipment.

Install the equipment so that, with the exception of the connections to the host, clearance and creepage distances shown in Table 5 are maintained between the board and any assemblies that use or generate a voltage shown in the table below. The larger distance shown in brackets applies where the local environment within the

host is subject to conductive pollution or dry non-conductive pollution, which could become conductive due to condensation. Failure to maintain these minimum distances would invalidate the safety approval.

Table 5 TR114 Clearance Requirements

Clearance (mm)	Creepage (mm)	Voltage used or generated by host or other boards
2.0	2.4 (3.8)	Up to 50 Vrms or Vdc
2.6	3.0 (4.8)	Up to 125 Vrms or Vdc
4.0	5.0 (8.0)	Up to 250 Vrms or Vdc
4.0	6.4 (10.0)	Up to 300 Vrms or Vdc
(see note below)		Above 300 Vrms or Vdc

Note: For a host or other expansion board fitted in the host using or generating voltages greater than 300V (rms or dc), you must obtain advice from a competent telecommunications safety engineer before installing the relevant equipment.

To understand the spacing requirements, refer to Figure 1.

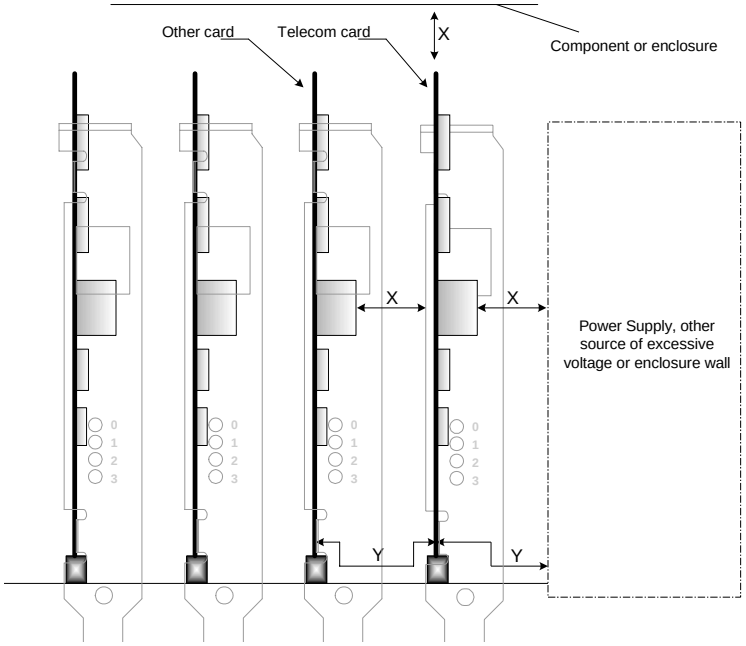


Figure 1 Identification of Creepage and Clearance Distances (viewed facing the bracket)

Where:

X designates the clearance distance (straight line through air)

Y designates the creepage distance (shortest path over surface)

Refer to Table 5 on page 32 to determine the minimum distances required between the TR114 and other products.

Telephone Jack Pinout

This section describes Pinouts for TR114 BRI models and TR114 analog PCI model boards.

BRI Pinout

On all TR114 BRI models, the 8-pin RJ-45 jack (BRI A) accesses TR114 channels 0 and 1. On TR114+P4B boards, BRI B accesses TR114 channels 2 and 3.

The pinout for BRI A and BRI B is as follows:

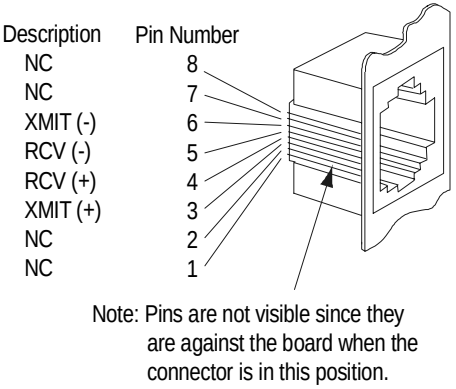


Figure 2 RJ-45 Pinout for BRI Boards

The cable included with the TR114 BRI boards connects the channels to single-pair wiring.

Analog PCI Pinout

Brooktrout provides the following information for users who might want to make their own telephone cords and who might want to access only one or two channels on the four-channel TR114 or only one channel on two-channel boards.

The TR114 PCI analog boards have one RJ-45 telephone plug. This jack accesses channels 0, 1, 2, and 3.

The splitter cable included with the board connects the channels to single-pair wiring. Two-channel boards are supplied with a two-split cable; four-channel boards are supplied with a four-split cable.

The pinout for the RJ-45 jack is as follows:

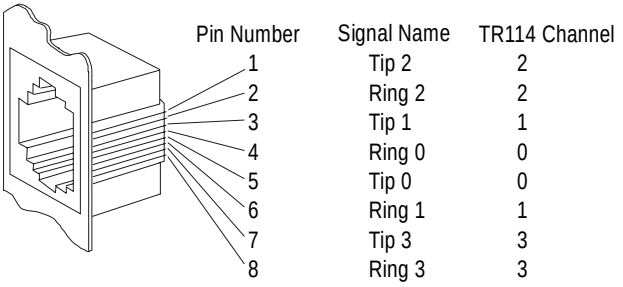


Figure 3 RJ-45 Pinout for Analog (PCI) Boards

Monitoring LED Activity

LED activity can be useful in diagnosing difficulties with the board. This appendix covers the significance of LED activity for:

- PCI Loop-Start Boards
- PCI Direct Inward Dialing (DID) Boards
- PCI Basic Rate Interface (BRI) Boards

PCI Loop-Start Boards

Mounting Brackets

The TR114 PCI loop-start analog board has red LEDs on the mounting bracket (Figure 4).

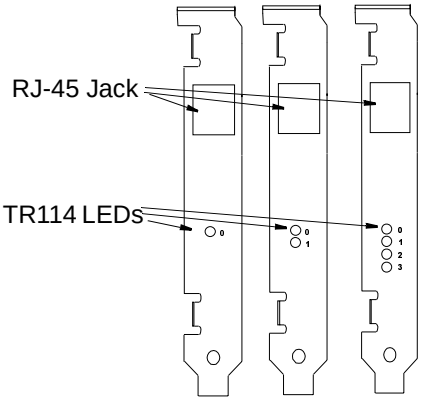


Figure 4 Mounting Brackets: LEDs for P1L, P2L, and P4L

TR114 PCI LED Channel Activity

Each LED indicates the activity status of its associated channel. The LEDs will:

- Flash once at PC power up.
- Flash periodically after firmware is downloaded to the TR114.
- Become solid red when the channel goes off hook.
- Flash when the channel is receiving data from the host computer.

PCI Direct Inward Dialing (DID) Boards

Mounting Brackets

Figure 5 shows the LEDs, RJ-45 jacks and the plug for the DID power supply on the mounting brackets of the TR114 PCI analog DID board.

The green LED shows the status of the DID power supply. The red LEDs show the status of the TR114 channels.

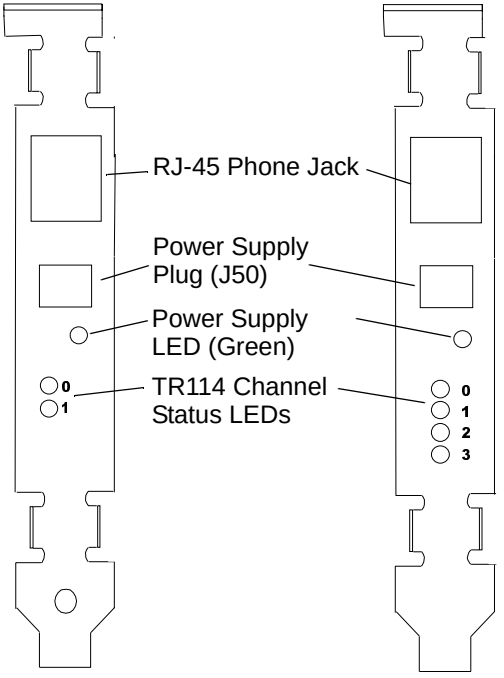


Figure 5 Mounting Bracket: LEDs, Jacks, and Power Supply for TR114 PCI Analog DID Board

Red LEDs: TR114 Channel Activity

Each red LED indicates the activity status of its associated channel. The LEDs will:

- Flash once when the computer is powered up.
- Flash rapidly while the firmware is being downloaded to the board.
- Become solid red when the channel goes off hook.
- Turn off when the channel goes on hook.
- Flash periodically whether on or off hook to indicate the channel is alive.

Green LED: DID Power Supply

The green LED remains on when the DID power supply is supplying power.

PCI Basic Rate Interface (BRI) Boards

Mounting Brackets

Figure 6 shows the mounting brackets for TR114+P2B and P4B boards.

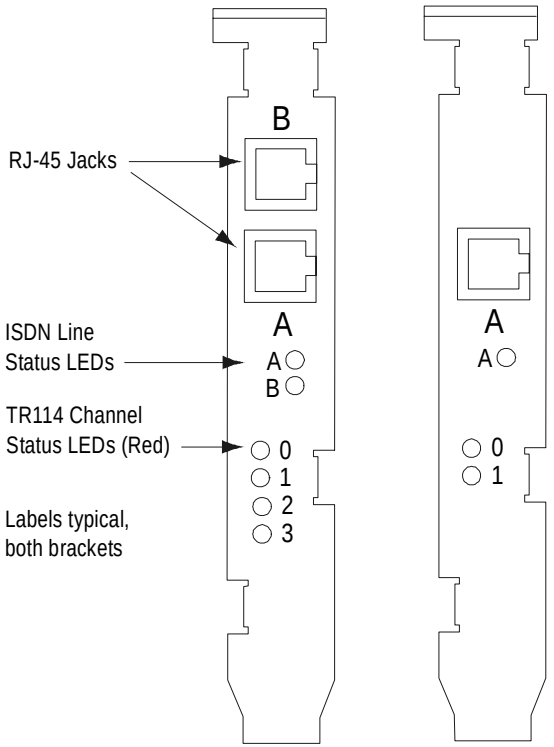


Figure 6 Mounting Brackets for TR114 P2B and P4B

Red LEDs: TR114 Channel Activity

You can monitor the TR114 channels using the LEDs. The red LEDs indicate the activity status of their associated TR114 channels. The LEDs will:

- Flash once at computer power up.
- Flash periodically after the TR114 firmware is downloaded.
- Become solid red when the channel goes off hook.
- Flash when the channel is receiving data from the host.

Green LEDs: ISDN Channel Activity

The green LEDs are associated with the ISDN channels, A and B.

The green LED only changes state immediately after a call attempt. For example, when you first initialize the board, the LED remains on (with periodic pulsing off) even with the cable disconnected. When a call is attempted, the LED goes off (with periodic pulsing on). When the cable is reconnected, the LED remains in the off state until another call is attempted.

Each green LED indicates the activity status of its associated ISDN line:

- OFF when the board is not initialized.
- Continuously ON, with periodic pulsing OFF, to indicate normal operation.
- Continuously OFF, with periodic pulsing ON, to indicate failure to establish the ISDN telephone service. Causes of this failure might be:
  - Faulty cable connection.
  - Board is configured with a data link different from the one provided by the network: for example, the network is point-to-multipoint and the data link for the ISDN TR114 is point-to-point.

Regulatory Notices

The following standards cover requirements for using hardware in compliance with various regulatory agencies. In some configurations the TR114 is required to comply with TBR21 (Technical Body Regulations) European Union Telco requirements.

Notice to Users of Brooktrout TBR 21 Boards

With respect to 98/482/EC, Annex II

This equipment has been approved in accordance with Council Decision 98/482/EC for pan-European single terminal connection to the Public Switched Telephone Network (PSTN). However, due to differences between the individual PSTNs provided in different countries, the approval does not, of itself, give an unconditional assurance of successful operation on every PSTN network termination point.

In the event of problems, you should contact your equipment supplier in the first instance.

With respect to 98/482/EC, Annex III

This equipment is designed to operate correctly on the networks of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Norway, Portugal, Spain, Sweden, Switzerland, Netherlands, and UK.

Operational problems might occur in Spain when this equipment is installed at a great distance from the central exchange.

This equipment is not designed to be installed in series with any other telecommunications equipment. Installation of this equipment in parallel with other telecommunications equipment might result in malfunction.

There are no adjustments required to use this equipment on the above listed networks.

Standards Compliance

The following section describes standards compliance for North America and Canada.

North America

Note to developers, system integrators, value added resellers and distributors:
The following compliance information must be provided to your customer and the end user as part of your system documentation.

In the United States, the Federal Communications Commission (FCC) and in Canada, Industry Canada (IC), regulate all electronic devices that connect to the telephone system and/or generate radio frequency signals. The TR114 is such a device and must comply with the regulations specified below.

Telephony Regulations

FCC Regulations Regarding Connection to the Phone Line (Part 68):

The Federal Communications Commission (FCC) has established rules, which permit the TR114 to be directly connected to the telephone network.

- Jacks used in the premises wiring for connection to the telephone network must comply with FCC Rules, Part 68. Please refer to information below for the correct jack to use for each service. An FCC-compliant modular cable with compliant plugs on each end is supplied to interconnect the board and the premises wiring or telephone network.
- This equipment cannot be used on coin service provided by the telephone company. Connection to party lines is subject to state tariffs. (Contact your state public utility commission or corporation commission for information.)

A malfunctioning circuit can harm the telephone network. Disconnect a malfunctioning TR114 board from the telephone network until you determine the cause of the malfunction and repair it. If a malfunctioning TR114 remains connected, the telephone company might temporarily disconnect service.

The telephone company might make changes in its technical operations and procedures. If such changes can affect compatibility with the TR114, the telephone company must give adequate notice of the changes.

The telephone company might request information on equipment connected to its lines. Give its representative the following information:

- The telephone number(s) to which the TR114 is connected
- The FCC registration number. See back of board.

For Loop-Start boards:

- The ringer equivalence number (REN). See back of board.
- The type of wall jack required - # USOC-RJ-11C
- The facility interface code - # 02L52

For DID boards:

- The service order code - # 9.0F
- The type of wall jack required - # USOC-RJ-11C
- The facility interface code - # 2RV2-T

The ringer equivalence number (REN) determines how many devices can be connected to your telephone line. In most areas, the sum of the RENs of all the devices on any line should not exceed 5. If too many devices are attached, they might not ring properly. REN does not apply to DID or digital lines.

When assembling a system, the registration numbers of all devices must be listed on the exterior of the final assembly for easy access.

FCC Rules Regarding Fax Branding

The Telephone Consumer Protection Act of 1991 makes it unlawful for any person to use a computer or other electronic device to send any message via a telephone fax machine, unless such message clearly contains, in a margin at the top or bottom of each transmitted page, or on the first page of the transmission, the date and time the message is sent and an identification of the business, other entity, or other individual sending the message and the telephone number of the sending machine or such business, other entity, or other individual.

Users

To program this information into your fax machine, complete the procedure described in your user's manual.

Developers

You must include facilities in your application to enable the user to enter the required information. Use the BfvFaxHeader function to place this information on the transmitted page(s) as required. You must also include in your user's manual instructions for entering this information into your system.

IC Equipment Attachment Limitations (CS-03)

The Industry Canada label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational, and safety requirements. Industry Canada does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line individual service might be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions might not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, might give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines, and internal metallic water pipe system, if present, are connected together. This precaution might be particularly important in rural

areas. Users should not attempt to make installation connections themselves, but should contact the appropriate electric inspection authority or electrician, as appropriate.

The ringer equivalence number (REN) assigned to each terminal device provides an indication of the maximum number of terminals allowed to be connected to a telephone interface. The termination on an interface might consist of any combination of devices subject only to the requirement that the sum of the RENs of all the devices does not exceed 5.

The Industry Canada certification number is found on the back of the board.

Electromagnetic Emissions

This product was tested for emissions in a personal computer meeting the limits of FCC Rules, Part 15 Class B. In order to ensure that it continues to meet the Class A emissions limits, it should be installed in a host computer or other enclosure that also meets the Class B limits and bears an FCC Rules, Part 15 registration number, an FCC logo and/or a CE marking.

FCC Emissions Information

All computing devices utilizing clock frequencies in excess of 10 kHz must be tested for compliance with RF emission limits set by the FCC.

The TR114 has been tested as a Class A computing device.

Changes or modifications to this unit not expressly approved by Brooktrout Technology, Inc. could void the user's authority to operate the equipment.

Pursuant to Part 15 of the FCC Rules, this equipment has been tested and found to comply with the limits for a Class A digital device. These limits provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate

radio frequency energy, and if not installed and used in accordance with the instruction manual, might cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case, the user will be required to correct the interference at his or her own expense.

IC Emissions Notice

This Class A digital apparatus complies with Canadian ICES-003. Cet appareil numérique de la class A est conforme à la norme NMB-003 du Canada.

Safety

The TR114 is recognized by ETL; the component recognition number is on the back of the board. The TR114 has been tested and complies with UL Standard 1950, 3rd ed./ CSA C22.2 No. 950-95, 3rd ed. “Safety of Information Technology Equipment, Including Electrical Business Equipment.”

This product must be mounted in the final assembly so that it is isolated from exposure to any hazardous voltages (voltages greater than 42.4 Vac peak or 60 Vdc) within the assembly. Adequate separation and restraint of cables and cords must be provided.

To maintain the safety certification of the system, ensure that the power drawn from the power supply does not exceed its capacity. Please refer to the usage tables about *Power* on page xv in the Preface for information on the voltages and currents required for proper operation.

For further regulatory information on all Brooktrout LAN Fax products, please visit http://www.brooktrout.com/products/approvals.

B
Result Codes

This appendix provides information about call progress error codes, result error codes, and ISDN cause codes, location octet, cause value octet, and diagnostic octet.

It includes the following sections:

- Final Call Progress Signals
- Fax Hang-up Codes
- Reset Error Codes
- ISDN Cause Codes

Final Call Progress Signals

Since the software returns the value of final call progress codes at the end of phase A when no fax information transfer has taken place, any issues are telephony and not fax related. These would be logged in cases such as:

- Failure to dial out from behind a PBX
- Invalid numbers
- No connection/open circuit cables
- Invalid/incorrect country code selection.

Table 6 Final Call Progress Codes

Value	Call	Progress Type Description
301	BUSY1	Normal busy; remote end busy (off-hook).
302	BUSY2	Normal busy; remote end busy (off-hook). Used instead of BUSY1 in certain countries.
303	ROBUSY	Reorder or fast busy; indicates that telephone company trunk lines are busy; on PBXs, indicates no available outside lines.
304	RECALL	Recall dial tone detected; signal generated when calling another party while already connected to one or more parties (for example, conference calling, call waiting).
305	CONFIRM	Confirmation tone; automated equipment acknowledges successful completion of caller requested feature (for example, call forwarding). This is not G2 confirmation tone (CFR2).
308	RING1	Ringback detected; remote end is ringing. The Central Office connected to the dialed number generates this signal.
309	RING2	Ringback detected; remote end is ringing. The Central Office connected to the dialed number generates this signal. Also known as double-ring, it is used in the U.K.
316	HUMAN	Answer (probable human) detected; does not match any other expected call progress signal patterns.
318	DIALTON	Dial tone detected; usually indicates the dialing sequence did not break dial tone.

Table 6 Final Call Progress Codes (Continued)

Value	Call	Progress Type Description
325	RNGNOANS	Indicates the remote end was ringing but did not answer. In fax mode, this result occurs after the `ced_timeout` (default: 40 secs) has expired and the line continues to ring. (You can adjust the value of these timeout parameters in the *btcall.cfg* configuration file.)
326	G2DETCT	Group 2 fax machine detected; remote machine is capable of sending and receiving G2 facsimiles only.
327	SITINTC	Intercept tone detected; remote end originating failure; invalid telephone number or class of service restriction. With the ISDN TR114, this can also indicate a datalink mismatch (ptp or pmp).
328	QUIET	After dialing the number, no energy detected on the line for the `wait_for_ced` timeout period; possible dead line.
329	SITVACODE	Vacant tone detected; remote originating failure; invalid telephone number.
330	SITREORD	Reorder tone detected; end office (PBX) or carrier originating failure.
331	SITNOCIR	No circuit detected; end office or carrier originating failure, possible dead line.
333	RMTOFFHK	Note: depending on the configuration of the CO, T1 and E1 connections might not use or provide in-band signaling.
348	ISDN_CALL_PROGRESS	By enabling call progress on an ISDN D channel, one of the following values is in the second byte of the FIFO buffer: 4 = CALL_PROCEEDING: Call is proceeding normally. 5 = CALL_ALERTING: Ringback detected; remote end is ringing 6 = CALL_CONNECTED: Call is connected 7 = CALL_DISCONNECTED: Call was disconnected
349	ISDN_CALL_COLLISION	Indicates that a call collision occurred on the ISDN line.

Fax Hang-up Codes

The fax hang-up codes are first divided into whether the fax was originating, or answering. They are further grouped into which of the T.30 phases the hang up occurred. The codes and a brief description of each code are listed below.

From the hang-up code, it is possible to identify during which phase the hang up occurred, whether the board was originating or answering, and obtain a description. To further identify exactly the cause of the hang up would require a detailed knowledge of the T.30 protocol.

Table 7 Fax Hang-up Codes

Value	Hang-up code	Description
Call Placement Phase A Codes		
0	HNG_NORMAL_XMIT	Normal and proper end of connection.
1	HNG_RNG_DET	Ring detected without a successful handshake.
2	HNG_ABORT	Call Aborted.
3	HNG_NO_LOOP_CURRENT	No loop current or A/B signaling bits.
4	HNG_ISDN_DISCONNECT	ISDN disconnection.
11	HNG_T1_TIMEOUT	No answer, T.30 T1 timeout.
Transmit Phase B Codes		
20	HNG_XMITB_TIMEOUT	Unspecified transmit Phase B error.
21	HNG_XMITB_NORM	Remote cannot receive or send.
22	HNG_XMITB_MISC	COMREC error, Phase B transmit.
23	HNG_XMITB_COMREC_VCNR	COMREC invalid command received.
24	HNG_XMITB_SE	RSPREC error.
25	HNG_XMITB_DCS_FTC	DCS send three times without response.
26	HNG_XMITB_DIS_FTC	DIS/DTC received three times; DCS not recognized.
27	HNG_XMITB_TRAINFAIL	Failure to train.
28	HNG_XMITB_RSPREC_VCNR	RSPREC invalid response received.

Table 7 Fax Hang-up Codes (Continued)

Value	Hang-up code	Description
29	HNG_XMITB_COMREC_DCN	DCN (fax disconnect message) received in COMREC.
30	HNG_XMITB_RSPREC_DCN	DCN received in RSPREC.
33	HNG_PHASEB_INCOMPAT_FMT	Incompatible fax formats, for example, a page width mismatch.
34	HNG_XMITB_INVAL_DMACNT	Invalid DMA count specified for transmitter.
35	HNG_XMITB_FTM_NOECM	Binary File Transfer specified, but ECM not enabled on transmitter.
36	HNG_XMITB_INCMP_FTM	Binary File Transfer mode specified, but not supported by receiver.
Transmit Phase D Codes		
40	HNG_XMITD_RR_NORES	No response to RR after three tries.
41	HNG_XMITD_CTC_NORES	No response to CTC, or response was not CTR.
42	HNG_XMITD_T5TO_RR	T5 time out since receiving first RNR.
43	HNG_XMITD_NOCONT_NSTMSG	Do not continue with next message after receiving ERR.
44	HNG_XMITD_ERRRES_EOREOP	ERR response to EOR-EOP or EOR-PRI-EOP.
45	HNG_XMITD_RTN_DCN	Transmitted DCN after receiving RTN.
46	HNG_XMITD_PPR_EOR	EOR-MPS, EOR-EOM, EOR-NULL, EOR-PRI-MPS, or EOR-PRI-EOM sent after fourth PPR received.
51	HNG_XMITD_SE	RSPREC error.
52	HNG_XMITD_MPS_FTC	No response to MPS, repeated three times.
53	HNG_XMITD_MPS_VCNR	Invalid response to MPS.
54	HNG_XMITD_EOP_FTC	No response to EOP repeated three times.
55	HNG_XMITD_EOP_VCNR	Invalid response to EOP.
56	HNG_XMITD_EOM_FTC	No response to EOM, repeated three times.
57	HNG_XMITD_EOM_VCNR	Invalid response to EOM.
60	HNG_XMITD_RSPREC_DCN	DCN received in RSPREC.

Table 7 Fax Hang-up Codes (Continued)

Value	Hang-up code	Description
61	HNG_XMITD_PPSNULL_NORES	No response received after third try for PPS-NULL.
62	HNG_XMITD_PPSMPS_NORES	No response received after third try for PPS-MPS.
63	HNG_XMITD_PPSEOP_NORES	No response received after third try for PPS-EOP.
64	HNG_XMITD_PPSEOM_NORES	No response received after third try for PPS-EOM.
65	HNG_XMITD_EORNULL_NORES	No response received after third try for EOR-NULL.
66	HNG_XMITD_EORMPS_NORES	No response received after third try for EOR-MPS.
67	HNG_XMITD_EOREOP_NORES	No response received after third try for EOR-EOP.
68	HNG_XMITD_EOREOM_NORES	No response received after third try for EOR-EOM.
Receive Phase B Codes		
70	HNG_RCVB_TIMEOUT	Unspecified receive Phase B error.
71	HNG_RCVB_SE	RSPREC error.
72	HNG_RCVB_MISC	COMREC error.
73	HNG_T2_PNOTREC T.30	T2 timeout, expected page not received.
74	HNG_RCVB_T1_TIMEOUT	T.30 T1 timeout after EOM received.
75	HNG_NORMAL_RCV	DCN received in COMREC.
76	HNG_RCVB_RSPREC_DCN	DCN received in RSPREC.
77	HNG_T2_TIMEOUT T.30	T2 timeout, expected page received.
78	HNG_RCVB_INVAL_DMACNT	Invalid DMA count specified for receiver.
79	HNG_RCVB_FTM_NOECM	Binary File Transfer specified, but ECM not supported by receiver.
Receive Phase D Codes		
101	HNG_RCVD_SE_VCNR	SPREC invalid response received.
102	HNG_RCVD_COMREC_VCNR	COMREC invalid response received.
103	HNG_RCVD_T3TO_NORESP	T3 timeout; no local response for remote voice interrupt.

Table 7 Fax Hang-up Codes (Continued)

Value	Hang-up code	Description
104	HNG_RCVD_T2TO	T2 timeout; no command received after responding RNR.
105	HNG_RCVD_DCN_COMREC	DCN received for command received.
106	HNG_RCVD_COMREC_ERR	Command receive error.
107	HNG_RCVD_BLKCT_ERR	Receive block count error in ECM mode.
108	HNG_RCVD_PGCT_ERR	Receive page count error in ECM mode.
Miscellaneous Codes		
240	HNG_INTERRUPT_ACK	No interrupt acknowledges, timeout.
241	HNG_COMM_FAULT	Loop current still present while playing reorder tone after timeout.
242	HNG_T30_HOLDUP	T.30 holdup timeout.
243	HNG_HOLDUP_DCN	DCN received from host in receive holdup section for FAX PAD mode.
244	HNG_HOLDUP_DCN_NON_FPAD	DCN received from host in receive holdup section for non-FAX PAD mode.

Reset Error Codes

You might get error codes during the reset of the TR114. You can add the numbers at the end of each bit value and get a unique number. This unique number is returned by the reset function, and you can then reduce the number back to its original elements.

For example, the reset error 1b means:

0x00000010L

AND

0x00000008L

AND

0x00000002L

AND

0x00000001L

The following table identifies reset status condition bit values, as returned.

Table 8 Reset Error Codes

Bit Value	Related Function	Explanation
0x00000001L	#define RST_RSTDONE_TIMEOUT	Timeout occurred waiting for reset done interrupt (fatal).
0x00000002L	#define RST_MAGIC_BAD	TR114 has a bad magic number (fatal).
0x00000004L	#define RST_RSTDONE_NOMODEM	The reset occurred, but the channel reported that it has no modem.
0x00000008L	#define RST_USR_CONFIG_UNREADABLE	The user configuration file could not be opened/read.
0x00000010L	#define RST_USR_CONFIG_BADFORMAT	The user configuration file is not in the correct format.
0x00000020L	#define RST_CPARM_UNREADABLE	The country parameter file could not be opened/read, possible bad format.
0x00000040L	#define RST_COUNTRY_NOTFOUND	The country specified in the user configuration file could not be found.

Table 8 Reset Error Codes (Continued)

Bit Value	Related Function	Explanation
0x00000080L	#define RST_FIRM_UNREADABLE	The TR114 firmware file specified in the user configuration file could not be opened/read (fatal).
0x00000100L	#define RST_FIRM_DLOAD_ERR	An error occurred during TR114 firmware download (fatal).
0x00000200L	#define RST_FONT_UNREADABLE	A font file specified in the user configuration file could not be opened/read.
0x00000400L	#define RST_FONT_DLOAD_ERR	An error occurred during font download (fatal).
0x00000800L	#define RST_DAA_BAD	The TR114 DAA bytes are not valid.
0x00001000L	#define RST_DID_BATT_MISSING	A TR114 DID channel does not have a battery connected.
0x00002000L	#define RST_HW_VERSION_BAD	The hardware version that the channel reported is not valid.
0x00004000L	#define RST_DIG_CONFIG_UNREADABLE	The TR114 digital/ISDN configuration file specified in the user configuration file could not be opened/read.
0x00008000L	#define RST_DIG_CONFIG_BADFORMAT	The TR114 digital/ISDN configuration file specified in the user configuration file is not in the correct format (fatal).
0x00010000L	#define RST_DIG_HW_ERR	A hardware error occurred during TR114 digital/ISDN configuration (fatal).
0x00020000L	#define RST_MEM_ALLOC_ERR	A memory allocation error occurred.
0x00040000L	#define RST_ALERT	An alert occurred (fatal).
0x00080000L	#define RST_INT_ERR_OVRN	An error interrupt or interrupt overrun occurred (fatal).
0x00100000L	#define RST_DRIVER_ERR	The driver reported an error during reset or initialization (fatal).
0x00200000L	#define RST_DIG_PARAM_ERR	Incorrect configuration parameters were specified, as reported by firmware, during TR114 digital/ISDN configuration (fatal).
0x00400000L	#define RST_DIAG_ERR	Channel reported a diagnostic error of some kind.

Table 8 Reset Error Codes (Continued)

Bit Value	Related Function	Explanation
0x00800000L	#define RST_MAX_TIMEOUT	Maximum timeout exceeded (fatal).
0x01000000L	#define RST_DIG_ERR_OTHER	Other TR114 digital/ISDN configuration error (fatal).
0x02000000L	#define RST_RETAIN_ERR	Error due to channel state retention attempt (fatal).

ISDN Cause Codes

When the ISDN network or remote user disconnects a call for any reason, the cause (IE) might be reported by any ISDN-aware application.

The cause IE consists of three significant octets:

- Location Octet
  A single general location octet that indicates where the disconnection message was generated.
- Cause Value Octet
  The actual cause value octet that provides a detailed description.
- Diagnostic Octet
  A diagnostic octet that might be added to provide further information.

Cause codes are not specific. They are guidelines and are implementation-dependent. Certain PTTs and PABX manufacturers use a smaller subset of cause codes, covering a wide range of possible problems.

Example 5 Disconnect Cause IE: 80 90

```
Disconnect cause IE: 80 90
```

Decode the message using the following table:

The general location is	0x80	Remote user
The cause value is	0x90	Normal clearing
No diagnostic octet		

The message shows the remote user disconnecting (hanging up) normally.

Location Octet

The following table lists the possible locations of the disconnect.

Table 9 General Location Octet

Hex	Value	Description
80	0	Remote user
81	1	Private network serving local user
82	2	Public network serving local user
83	3	Transit network
84	4	Public network serving remote user
85	5	Remote private network
87	7	International network
8A	10	Network beyond internetworking point

Cause Value Octet

The Cause Codes are grouped by class number.

- Class 000 — Normal Events, see Table 10 on page 61
- Class 010 — Network Congestion, see Table 11 on page 63
- Class 011 — Service or Option Not Available, see Table 12 on page 64
- Class 100 — Service or Option Not Implemented, see Table 13 on page 64
- Class 101 — Invalid Message, see Table 14 on page 65
- Class 110 — Protocol Error, see Table 15 on page 66
- Class 111 — Interworking, see Table 16 on page 67

Table 10 Class 000 — Normal Events

Hex	Value	Description	Meaning
81	1	Unallocated number	Indicates that the requested destination, although valid, cannot be reached.
82	2	No route to specified network	Sending equipment (sending the cause) is requested to route call through an unrecognized transit network.
83	3	No route to destination	Called user cannot be reached because the network does not serve the destination.
86	6	Channel unacceptable	The last identified channel is not acceptable to the sending entity.
87	7	Call awarded	Incoming call is connected to a channel already established fro similar calls (for example: packet-mode X.25 virtual calls).
90	16	Normal clearing	Call is cleared by one of the users involved.
91	17	User busy	Called user cannot accept another call although compatibility is established.
92	18	No user responding	When a user does not respond to call establishment messages with either an alerting or connect indication within the allowed time.
93	19	User altering, no answer	User provided an alerting indication but has not provided a connect indication within the allowed time.
95	21	Call rejected	Equipment sending the cause does not want to accept this call although the equipment is busy or incompatible.
96	22	Number changed	Indicates called party number is not assigned.
9A	26	Nonselected user clearing	User not awarded the incoming call.
9B	27	Destination out of order	Destination interface is not functioning correctly. The cause has special significance with the TR114 ISDN board. This message usually indicates a failure to establish layer 2. Other symptoms include a failure to fax to any number and a failure to answer any calls. Typically caused by either physical cable problems or an incorrect datalink protocol. Change the datalink protocol, using *briconf*. If the error message still persists, check the cable connection. Use the onboard protocol analyzer to determine the exact nature of the problem.

Table 10 Class 000 — Normal Events (Continued)

Hex	Value	Description	Meaning
9C	28	Invalid number format	Called party number is invalid or incomplete.
9D	29	Facility rejected	Network cannot provide the facility requested.
9E	30	Response to STATus ENQuiry	The reason for generating the STATUS message was the prior receipt of a STATUS ENQUIRY message.
9F	31	Normal unspecified	Used to report normal events only when no other cause in the normal class applies.

Table 11 Class 010 — Network Congestion

Hex	Value	Description	Meaning
A2	34	No channel available	An appropriate channel is not currently available to handle the call.
A3	35	Call queued (AT&T)	Network is not functioning. Immediate redial is unlikely to succeed.
A6	38	Network out of order	Network is not functioning. Immediate redial is unlikely to succeed.
A9	41	Temporary failure	Network is not functioning. Immediate redial is unlikely to succeed.
AA	42	Switching equipment congestion	Switching equipment generating this cause is experiencing a period of high traffic. AB 42 user information is discarded. The network can not deliver access information to the remote user as requested. For example: ■ a user-to-user information ■ low-layer compatibility ■ subaddress as indicated in the diagnostic The particular type of discarded access information is optionally included in the diagnostic.
AC	44	Requested channel not available	The channel indicated by the requesting entity cannot be provided by the other side of the interface.
AF	47	Resources unavailable or unspecified	A resource unavailable event only when no other cause in the resource unavailable class applies.

Table 12 Class 011 — Service or Option Not Available

Hex	Value	Description	Meaning
B1	49	Quality of service unavailable	Throughput or transit delay cannot be supported. The Quality of Service (as defined in Recommendation X.213) cannot be provided.
B2	50	Requested facility not subscribed	Requested supplementary service not provided by the network because the user has not completed the necessary administrative arrangements with its supporting networks.
B4	52	Outgoing calls barred (AT&T)	
B6	54	Incoming calls barred	
B9	57	Bearer capability not authorized	User is trying to make unauthorized use of equipment providing a bearer capability.
BA	58	Bearer capability not presently available	User has requested a bearer capability that is implemented by the equipment generating the cause, but is not available at this time.
BF	63	Service or option not available or unspecified	A service or option not available event only when no other cause in the service or option not available class applies.

Table 13 Class 100 — Service or Option Not Implemented

Hex	Value	Description	Meaning
C1	65	Bearer capability not implemented	Equipment sending this cause does not support the requested bearer capability.
C2	66	Channel type not implemented	Equipment sending this cause does not support the requested channel type.
C5	69	Requested facility not implemented	Equipment sending this cause does not support the requested supplementary service.
C6	70	Only restricted digital available	Request for an unrestricted bearer service, but the equipment sending this cause only supports the restricted version.
CF	79	Service not implemented or unspecified	The service or option not implemented event only when no other cause in the service or option not implemented class applies.

Table 14 Class 101 — Invalid Message

Hex	Value	Description	Meaning
D1	81	Invalid call reference value	A message with a call reference that is not currently in use on the user network interface received by the equipment sending the cause.
D2	82	Channel does not exist	Equipment sending this cause received a request to use a channel not activated on the interface for a call.
D3	83	Suspended call exists, call identity does not	A call resume attempted with a call identity that differs from that in use for any currently suspended call.
D4	84	Call identity in use	Network received a call suspended request. The request contained a call identity (including the null call identity) that is already in use for a suspended call within the domain of interfaces over which this call can be resumed.
D5	85	Invalid digit value for number	Network received a call resume request. The request contained a call identity information element that does not indicate any suspended call within the domain of interfaces over which the call can be resumed.
D6	86	Call having the requested call identity is cleared	The network has received a call resume request. This request contained a call identity information element that once indicated a suspended call; the suspended call was cleared while suspended (either by network timeout, or by a remote user).
D8	88	Incompatible destination	Equipment sending this cause received a request to establish a call that has low layer compatibility, high layer compatibility attributes (for example, data rate) that cannot be handled.
DB	91	Transit network does not exist	
DF	95	Invalid message unspecified	Invalid message event only when no other cause in the invalid message call applies.

Table 15 Class 110 — Protocol Error

Hex	Value	Description	Meaning
E0	96	Mandatory information element is missing	Equipment sending this cause received a message that is missing an information element that must be present in the message before that message can be processed. The particular information element is identified in the diagnostic octet. For example, 81 E0 04 means that the bearer capability is not included by the PABX (Private Network) in the SETUP message. 0x04 is the bearer capability information element identifier as specified in the standards.
E1	97	Message type nonexistent or not implemented	Equipment sending this cause received a message with a message type it does not recognize: ■ Undefined message ■ Defined but not implemented by the equipment sending the cause
E2	98	Message not compatible with call state or message type nonexistent or not implemented	Equipment sending this cause received a message that it considers non-permissible while in the call state or a STATUS message indicating an incompatible call state.
E3	99	Information element nonexistent or not implemented	Equipment sending this cause received a message that includes information elements not recognized because the information element identifier is not defined, or is defined but not implemented by the equipment sending the cause. However, the information element is not required to be present in the message to enable the equipment sending the cause to process the messages. When this cause is presented by the board, the particular information element is identified in the diagnostic octet. For example 81 E3 04, would mean that the bearer capability had not been included by the PABX (Private Network) in the SETUP message. 0x04 is the bearer capability information element identifier as specified in the standards.
E4	100	Invalid information element contents	Equipment sending this cause received an information element that it has implemented. However, the sending equipment was not able to implement the code because one or more of the fields were incorrectly coded.

Table 15 Class 110 — Protocol Error (Continued)

Hex	Value	Description	Meaning
E5	101	Message not compatible with call state	The received message is incompatible with the call state.
E6	102	Recovery on timer expiry	A timer expired and an associated Q.931 error handling procedure is initiated.
EF	111	Protocol error, unspecified	An error event only when no cause in the protocol error class applies

Table 16 Class 111 — Internetworking

Hex	Value	Description	Meaning
FF	127	Interworking unspecified	Interworking with the network that does not provide cause codes for its actions. Therefore, the precise cause for a message being sent is unknown.

Diagnostic Octet

For protocol errors where the cause octet indicates a class of 110 — protocol error, the diagnostic octet might indicate the particular message or information element identifier. For example, 81 E0 04 means that the bearer capability is not included by the PABX (Private Network) in the SETUP message. 0x04 is the bearer capability information element identifier as specified in the standards.

Table 17 Diagnostic Byte

Hex	Value	Description
02	2	Transit network identity or network specific facility information element identifier
16	22	New destination number
1D	29	Facility identification
2B	43	Discarded information element identifier
2F	47	Information element identifier
39	57	Attributes of bearer capability
3A	58	Attributes of bearer capability
41	65	Attributes of bearer capability
42	66	Channel type
58	88	Incompatible parameter
5F	95	Message type
60	96	Information element identifier
61	97	Message type
62	98	Message type
63	99	Information element identifier

Table 17 Diagnostic Byte (Continued)

Hex	Value	Description
64	100	Information element identifier
65	101	Message type
66	102	Timer number

C
Configuration Files

This appendix describes the structure of the configuration files.

It contains the following sections:

- About the Configuration Files
- User-Defined Configuration File
- ISDN Configuration File
- BT_CPARM.CFG
- BRI Configuration Utility

About the Configuration Files

The following configuration files are discussed in this chapter.

- The user-defined configuration file (*btcall.cfg*).

  This file contains configuration parameters for the API and driver. This file is also called *user.cfg*.
- The ISDN configuration file (*isdn.cfg*), which applies only to TR114 BRI boards.

  This File contains ISDN configuration parameters.
- The *BT_CPARM.CFG* file.

  This is a read-only file that contains country-specific parameters.
- The *bri.cnf* configuration utility.

  This program can be used to enter the configuration parameters into the FLASH memory. It can also be used to initialize the daughtercard and download new daughtercard firmware.

User-Defined Configuration File

The user-defined configuration file contains parameters that set values such as the number of DID digits. A default configuration file named *btcall.cfg* is supplied with the Brooktrout API (Application Programming Interface) and is typically included in your LAN-fax software. Before you start, please read your LAN-fax documentation about how to configure the Brooktrout board using your LAN-fax software. Table 18 provides a list of the Brooktrout parameters as reference in case you need to edit your *btcall.cfg* file manually. Brooktrout strongly recommends that you modify only *did_digits* (and *did_variable*) parameters for TR114 BRI boards and the debug parameters.

Keywords define the parameters and can be listed in any order and typed in either upper or lower case or both. Only one keyword per line is permitted. Keywords must be separated from their values – a decimal integer, a hexadecimal integer, or a character string – by one or more spaces. Commas, colons, and dashes are not valid keyword separators. The default value is automatically supplied for each missing keyword; and keywords that do not match any of the valid keywords are ignored. If a keyword appears more than once, the last occurrence is the one that takes effect.

Any line that begins with the # character is treated as a comment and is ignored. All character strings that represent filenames must consist of printable ASCII characters. Do not include white space characters such as space and tabs. If no board type is listed in the description, the keyword applies to all board types.

Table 18 Configuration File Keywords

Keyword	Board	Description
afe_config	TR114	AFE local echo configuration bytes, which override the TR114's normal AFE configuration. The channel number must be in decimal, followed by the three configuration bytes in hexadecimal. The API examines only the configuration file line that matches the current channel. This feature permits all channels in a system to continue to use a single configuration file. Contact Brooktrout Technical Support before using this keyword. Value Type: decimal and hex Default: AFE configuration bytes are not sent to the board unless specified here.
agc	TR114 with Firmware V1.7+	Automatic gain control (AGC) method to use during speech recording (in decimal). 0 = None. 1 = Dynamic AGC; levels adjusted during recording. 2 = Postrecord AGC; optimal level computed and reported at end of record. Value Type: decimal Default: 2
bft_rcv_cap	TR114	Binary file transfer (BFT) reception and types that the channel is permitted to receive. Values are formed by ORing together the base values shown below. 0 = BFT reception disabled. 1 = T.434 BFT reception enabled. 2 = Basic Transfer Mode (BTM) reception enabled. 4 = Document Transfer Mode (DTM) reception enabled. Value Type: hex Default: 0
bt_cparm		Name of the country telephony parameter file to use. Parameter files created for API V4.0 and subsequent versions are guaranteed to be compatible with each other. Value Type: character string Default: *BT_CPARM.CFG*.

Table 18 Configuration File Keywords (Continued)

Keyword	Board	Description
btnsf	TR114 with Firmware V1.7+ only	When non-zero, enables transmission of a Brooktrout NSF (on receive) or NSS (on transmit) that contains debugging information. Value Type: decimal Default: 0
busy_dt_ct		Number of consecutive `BUSY1`, `BUSY2`, `ROBUSY`, or `DIALTON` call progress values that must occur before terminating with the result of a busy or dial tone. Value Type: decimal Default: 1
cabs	TR114	Cable equalizer selector value. Valid values are: –1 = Uses the value in the *BT_CPARM.CFG* configuration file. 0 = No cable equalizer. 16 = Equalizer for 3.6km (2.2 mile) cable length. 32 = Equalizer for 1.8km (1.1 mile) cable length. 48 = Equalizer for 7.2km (4.5 mile) cable length. Value Type: decimal Default: Country dependent; the default in the *BT_CPARM.CFG* file is 0 for most countries, including the USA.
ced_timeout	TR114	In Fax Mode only, the length of time, in 10 ms units, to wait for a fax answer tone (CED tone) from a remote fax machine. This parameter can be set only if changing the `wait_for_ced` timeout is permitted by the host country. This parameter also controls the amount of time CNG plays. Value Type: decimal Default: Country dependent; 4000 (40 secs) in the USA.
country_code		International country code with modifiers. Initial digits (up to 3) identify the host country; the last digit supplies a modifier for properties such as the phone system attached to the board. The default is used for all TR114 PCI boards. Value Type: hex Default: 0010 (USA).

Table 18 Configuration File Keywords (Continued)

Keyword	Board	Description
debug	TR114	If this keyword is present, API debug mode is enabled using DEBUG_ALL, after restarting the application, if debug mode is not already enabled by the application. An optional filename can be specified, which sets up a debug function to send output to the specified file, if a debug function was not already set by the application. Value Type: string Default: disabled, stdout
did_digits		Number of DID digits to capture; the call is terminated if the specified number of DID digits is not detected. The maximum number is 63. This parameter is applicable for analog DID, T1 DNIS, and ISDN Called Party Number. DID behavior also depends on the value of the configuration file variable *did_variable*. Value Type: decimal Default: 4
did_variable		Sets the requirements for DID call detection based on the *did_digits* line parameter value and the interdigit time limit. 0 = The board detects a DID call only when it receives the number of decimal digits specified by *did_digits*. 1 = The board terminates the digits and detects a DID call when it receives the number of decimal digits specified by *did_digit* or when the interdigit time limit expires. If *did_digits* is 0, the maximum value for *did_digits* increases to 127 digits, and termination occurs based only on the timeout. Value Type: decimal Default: 0
digital		The name of the digital phone interface configuration file that contains PCM interface configuration information. Value Type: character string Default: *digital.cfg*

Table 18 Configuration File Keywords (Continued)

Keyword	Board	Description
dtmf_playoff	TR114 with FX164 and Firmware V1.7+ only	Frequency constraints that affect DTMF playoff and cut-through. DTMF playoff tones are false tones, which the board might inadvertently detect while playing back speech. Range: 0 to 3 A value of 0 provides the least playoff protection/greatest cut-through, and a values of 3 provides the greatest playoff protection/least cut-through. Value Type: decimal Default: 0
dtmf_thresh	TR114	DTMF detection threshold during voice play and record. 0.5 dB units, two's complement. Value is added to the default DTMF threshold of –28dB. Value Type: decimal Default: 0 (–28dB)
dtmf_twist	TR114 with FX164 and Firmware V1.7+ only	Maximum allowable twist between the low and high tones of each DTMF tone, as a decimal digit. 0–4–6 dB < max.twist < +3 dB 5–7 dB <max.twist < +4 dB 6+–8 dB < max.twist < +7 dB Value Type: decimal Default: 5
ecm_enable	TR114	ECM (error correction mode) is enabled or disabled. The normal ECM frame size is 256 bytes. You can enable a frame size of 64 bytes, but the board uses that frame size on transmit only. On receive, it always uses the frame size the transmitter selects. 0 = ECM disabled. 1 = ECM enabled, 256-byte frames. 2 = ECM enabled, 64-byte frames. TR114. Value Type: decimal Default: 1

Table 18 Configuration File Keywords (Continued)

Keyword	Board	Description
eff_pt_caps	TR114 with Firmware 2.0 only	Enhanced fax format page types that the channel is permitted to receive. Values are formed by ORing together the base values shown below. 0 = Enhanced fax format reception disabled 1 = JPEG 2 = Full color mode (JPEG) 8 = 12 bits/pel, otherwise 8 bits/pel (JPEG) 10 = No subsampling (JPEG) 20 = Custom illuminant (JPEG) 40 = Custom Gamut (JPEG) 100 = JBIG 200 = L0 Mode (JBIG) Value Type: hex Default: 0
error_enable	TR114	Error detection is enabled or disabled during fax reception in non-ECM mode as a decimal digit. Range: 0 to 1 Value Type: decimal Default: 1
error_mult	TR114	Error multiplication value used to determine if the error percentage on a received page is too high. The number of errors per page is multiplied by this number and the product is divided by 2. If this result exceeds the number of lines on the page, the error percentage per page is too high and an RTN signal is returned to the transmitting station. Value Type: decimal Default: 40 (for a 5% error rate)
error_thresh	TR114	The error threshold value of n (2n for fine resolution) consecutive bad G3 lines on a received page. A page with errors in this number of consecutive lines is considered bad, regardless of the results from *error_mult*. An RTN is returned when a “bad” page occurs. Value Type: decimal Default: 3

Table 18 Configuration File Keywords (Continued)

Keyword	Board	Description
firm16	TR114 with FX16 CPU only	See the description of the *firmware* keyword. Value Type: string Default: tr114-16.pex (no path)
firmware_2m *firm164_2m*	TR114 with FX164 CPU and 2MB of memory only	The name of the file to download that contains the TR114 firmware in packetized, executable (PEX) format. The firmware file must be in the current directory or the correct path must be included with its name. The file is opened and the contents are downloaded to the board the first time the board is reset at the beginning of the application. If the specified file cannot be read, the filename specified by the *firmware* keyword is used. Value Type: string Default: tr114-2m.pex (no path)
font_file	TR114	The name of the file that contains the transmit/convert font for ASCII. An optional font number, indicating the downloadable font to use, can be specified (if no font number is specified, 0 is assumed). The font file must be located in the current directory, or the correct path must be included with its name. Multiple occurrences of font file keywords with different font numbers are permitted in the configuration file. Some font numbers can be reserved for preloaded fonts. The TR114 supports eight fonts (0–7). Value Type: string; decimal can be included and is optional Default: ibmpcps.fz8 (no path) and 0
id_string		Default id string (up to 20 characters long) for fax machines; can be overridden by the application if change to the id string is permitted by the host country. Value Type: string Default: 20 spaces
immediate/wink		Selects immediate or wink start for DID analog channels. Value Type: string Default: wink

Table 18 Configuration File Keywords (Continued)

Keyword	Board	Description
isdn	TR114 ISDN BRI boards only	The name of the ISDN interface configuration file that contains ISDN interface configuration information. Value Type: string Default: isdn.cfg
line_compression	TR114	Specifies the permitted compression types for fax transmission or reception on the phone line. This specification is independent of the file format specified for transmission or reception. Valid values are: 0 = MH only. 1 = MR or MH. 5 = MMR, MR, or MH. Value Type: decimal Default: 5
max_pagelist		The maximum number of pages for which to store results during a call. Value Type: decimal Default: 30
max_timeout		Specifies the maximum time, in milliseconds, that the API delays waiting for activity to occur on a board. If any API function allows specification of a timeout value, that value takes precedence. Range: 0 to 2000000000, 0 = disable. Value Type: decimal Default: 0 (disabled)

Table 18 Configuration File Keywords (Continued)

Keyword	Board	Description
max_width	TR114	Sets the maximum page width permitted for fax reception. Valid values are: 0 = 215mm A4 1728 Normal resolution pixels 1 = 255mm B4 2048 Normal resolution pixels 2 = 303mm A3 2432 Normal resolution pixels 200Hx100V (Normal), 200Hx200V (fine), 300Hx300V, 400Hx400V, and 200Hx400V resolutions are all supported on the TR114. Value Type: decimal Default: 0
min_length	TR114 with Firmware V1.7+	Specifies the minimum number of lines required for a fax page received in non-ECM mode. The board considers any fax page with fewer lines invalid and responds with an RTN signal. 10 scan line units; range 0 to 255. Value Type: decimal Default: 0
missing_wait	TR114 with Firmware V1.7+ only	Specifies the delay to apply during dialing when the dial string does not contain a `'w'` or a `','` at the start of the dial string or immediately following an initial `'8'` or `'9'`. 50 ms units. Value Type: decimal Default: 20 (1 second)
nrings		The number of rings on which to answer an incoming call. Value Type: decimal Default: 1

Table 18 Configuration File Keywords (Continued)

Keyword	Board	Description
restrict_res	TR114	Specifies allowable resolutions for fax reception. Values are formed by ORing together the following values: 0 = only 200H x 100V (normal) 1 = 200H x 200V (fine) 2 = 200H x 400V 4 = 300H x 300V 8 = 400H x 400V 0 and 1 are applicable to TR114 and TruFax. 2, 4, and 8 are applicable to TR114. Regardless of the value chosen, 200H x 100V (normal) is always allowed. Value Type: hex Default: 1
subpwdsep	TR114 with Firmware V1.6 and later only	Enables reception of the SUB, PWD, and SEP FSK signals. Applications typically use these signals to direct or validate incoming calls. To form values, OR together the following base values: 0 = SUB, PWD, and SEP, reception disabled. (Firmware V1.6+) 1 = SEP reception enabled. (Firmware V1.7+) 2 = PWD reception enabled. (Firmware V1.7+) 4 = SUB reception enabled. (Firmware V1.6+) Value Type: hex Default: 0
switch_hook		The length of time (5 ms units) for a switch-hook flash. The maximum time a phone can momentarily be on-hook without being interpreted as a hang-up. This time varies depending on the telephone company, but, generally, any time from .25 to 1 second is usually safe. Value Type: decimal Default: 100 (500 milliseconds)
tone/pulse	TR114	Selects the default dialing type. Value Type: string Default: tone

Table 18 Configuration File Keywords (Continued)

Keyword	Board	Description
v_loop_break	Voice boards only	The length of time (in 10 ms units) loop current must be absent on a line before a disconnect interrupt is generated. Value Type: decimal Default: 80 (800 ms)
v_play_gain	TR114 with FX164 and Firmware V1.7+	Specifies the initial gain value for speech playback. A positive value indicates a step up; a negative value indicates a step down. The gain steps can also be called by the application. Range: –2 to 4. Value Type: decimal Default: 0
v_record_gain	TR114 with firmware version 1.8+/164 only	Specifies a gain boost during recording, in 6dB units. Range: 0 to 255 Value Type: decimal Default: 0
v_silence_thresh	TR114 and voice boards only (Not supported in Firmware V1.6 or earlier)	Sets the allowable amount of detectable noise/signal ratio for speech recording. The signal is considered silent until this noise level is surpassed. The higher the value, the higher the threshold. For example, with a value of 255, silence is detected even when a person screams into the receiver. Range: 0 to 255. Typical Value: 10 Value Type: decimal Default: 10 (The default value is appropriate for TR114 boards only.)
v_silence_wait	TR114 and voice boards only (Not supported in Firmware V1.6 or earlier)	Speech recording only. The time interval (1/10 second units) to wait after detecting silence before removing frames of silence. This time interval ensures recording continuity despite pauses or trailing off at the end of sentences. Value Type: decimal Default: 20

Table 18 Configuration File Keywords (Continued)

Keyword	Board	Description
v_timeout		Voice mode only. The maximum time (in seconds) to wait after the last dialed digit for a final call progress result. Value Type: decimal Default: 60 secs
width_res_ behavior	TR114	Specifies the action taken as a result of page width or resolution mismatches on fax transmission. Does not affect fax reception. Scaling the fax is not available for all combinations of resolution mismatches. 0 = Terminate the call. 1 = Horizontally and vertically scale the fax. 2 = Truncate the page. TruFax fax boards always truncate or pad the page. Value Type: decimal Default: 1

The following sample file does not include all configuration options. See your supplied *btcall.cfg* or *user.cfg* file.

```
did_digits 3
country_code 0010
id_string First_Fax
immediate
nrings 3
v_timeout 10
font_file ibmpcps.fz8
max_pagelist 25
```

ISDN Configuration File

This section applies to TR114 BRI boards only.

The ISDN configuration file is a user-supplied ASCII file that contains ISDN configuration information. It contains specific values for each channel. The `isdn` keyword in the user-defined configuration file, *btcall.cfg*,specifies the filename of the ISDN configuration file (the default is *isdn.cfg*).

Specifying all channels is not necessary, but all channels that a given configuration file will configure must be included in the file.

The lines of the ISDN configuration file consist of eight values in the following format:

```
channel bearer_capability calling_p_num calling_p_sub
local_add local_sub SPID bchan_pref
```

Table 19 ISDN Configuration Parameters

Parameter	Value
chan	TR114 channel number.
bearer	Bearer capability 1 = 3.1KHz Audio 2 = Speech
cpn	The calling party number (for outgoing calls). Can be disabled by specifying the character x, in which case the firmware uses the value of *local_add.* This option should be set to the same value for all channels using a single D channel.
cps	The calling party subaddress (for outgoing calls). Can be disabled by specifying the character x, in which case the firmware uses the value of *local_sub.* This option should be set to the same value for all channels using a single D channel.
local_add	The local address (for incoming calls). Can be disabled by specifying the character x.
local_sub	The local subaddress (for incoming calls). Can be disabled by specifying the character x.

Table 19 ISDN Configuration Parameters (Continued)

spid	The SPID. Can be disabled by specifying the character x.
bchan_pref	The B channel preference: 0 = No B channel preference will be sent; 1 = B1 channel is preferred; 2 = B2 channel is preferred; 3 = neither B channel is preferred.

Any line that begins with the # character is treated as a comment and is ignored.

The default *isnd.cfg* file for 4 channels:

```
01xxxxxx3
11xxxxxx3
21xxxxxx3
31xxxxxx3
```

The *isdn.cfg* file for 4 channels with bearer capability set to speech:

```
02xxxxxx3
12xxxxxx3
22xxxxxx3
32xxxxxx3
```

BT_CPARM.CFG

The *BT_CPARM.CFG* file is a read-only file and contains several sets of parameters, which are primarily telephony related (DTMF tone length, inter-digit times, etc.). A set of parameters is specific to a country or to a group of countries. Since some PTTs require specific values for these parameters, Brooktrout provides the values in this file. When using API version 4.0 and later, parameter files created for subsequent API versions are guaranteed to be compatible.

The location of *BT_CPARM.CFG* must be specified in the user-defined configuration file (see the *bt_cparm* keyword on page 75), or *BT_CPARM.CFG* must reside in the current directory.

BRI Configuration Utility

The ISDN TR114 has additional ISDN firmware, which interfaces the TR114 firmware to the ISDN network. This firmware remains on the board in FLASH memory even when power is down. Configuration parameters are also stored in this FLASH memory. These parameters alter the operation of the ISDN daughtercard firmware to match the particular installation and network characteristics. The *briconf* utility is a program that can be used to enter the configuration parameters into the FLASH memory. It can also be used to initialize the daughtercard and download new daughtercard firmware.

Daughtercard firmware prior to version 2.0 (Fw 2.00) cannot be configured. The *briconf* utility can be used to determine the current firmware version and can be used to download BRI firmware version 2.0, or later. For example, enter the following command in a DOS window:

```
briconf -f tr114.s
```

to download the firmware file *tr114.s*. This is only required once when upgrading daughtercard firmware because a new TR114 BRI board has already downloaded the FLASH onto it.

This program is included in the *testnt* test tool and can be downloaded from the Brooktrout web site as described on page 10. It is available for all Brooktrout API/driver versions for other operating systems, and in source form. In addition to using the *briconf* utility in combination with testnt, you can use it in combination with any application. If you want to use this tool with a particular Brooktrout API/driver and OS version, but do not find it on the Brooktrout web site, please contact Technical Support.

You must to configure the board using *briconf* if your network characteristics do not match the defaults of the board. By default, the ISDN TR114 is configured to operate with a point-to-multipoint datalink using the 3.1k Audio bearer capability. The TR114 retains its configuration even when power is removed. The command:

```
briconfig -p bri.cnf
```

configures using the parameters defined in file bri.cnf.

The *briconf* utility is supplied on the configuration and diagnostics CD. You can obtain the *briconf* source file and executables for other operating systems from the Brooktrout FTP site see *Downloading Software from the Brooktrout Web Site* on page 10 for instructions. The *briconf* utility works with BRI firmware version 2.0 or later.

Purposes *of briconf*

The *briconf* utility program is used for:

- Changing the ISDN configuration using *bri.cnf* file
- Initializing the ISDN daughter card
- Determining the ISDN firmware version
- Downloading BRI firmware updates
- Analyzing the ISDN protocol

When the *briconf* program is invoked, it reads the configuration settings from a user-modifiable configuration file, *bri.cnf*. It also sets certain parameters in flash memory on the ISDN daughter card. These parameters define the characteristics of the ISDN protocol and remain on the board even when power is removed.

If *briconf* is invoked with no arguments, it initializes ISDN. The version is displayed.

The following sections explain how to use the *briconf* utility and *bri.cnf* configuration file.

Running the *briconf* Utility

Note that before using *briconf*, the Brooktrout driver must be loaded.

The command line format for *briconf* is as follows:

briconf [{-p bri.cnf}{-f *filename*}-d{c|e|f}]

Command line options:

-p bri.cnf	Reads parameters from the configuration file, *bri.cnf*. Every time you run this utility, all of the ISDN parameters are reset. If you do not specify the ISDN parameters in *bri.cnf*, the software resets the default values for these parameters.
-f filename	Downloads firmware from the specified file.
-d c	Enables the ISDN circular buffer to capture all layer 2 and layer 3 information.
-d e	Stops the circular buffer and displays the captured trace information on the screen and in the file, *britrace.txt*.

Additional trace display options:

-d e a	Displays debug information for ISDN port A only.
-d e b	Displays debug information for ISDN port B only.
-d e w	Includes ISDN firmware warnings.
-d f	Resets the circular buffer.

If you invoke *briconf* with no arguments, it initializes the BRI daughter card to the default settings. However, manual initialization is not required, as initialization happens automatically.

You can also use *briconf* to download updated firmware to the BRI daughter board. For example:

briconf -f bfw233.s

Modifying ISDN Parameters

The configuration file *(bri.cnf)* consists of lines of keywords followed by the ISDN parameters. Each line in the *bri.cnf* file has the following format:

```
[{card_number bri_line bearer_chan
keyword [parameter] keyword [parameter] ...
```

The keywords, shown between brackets ([keyword]), specify optional information that applies to the parameters that follow. This optional information applies the keyword to a specific board, BRI line, or bearer channel. If you do not include any of the optional information, the keyword applies to all boards, both BRI lines, and both bearer channels (if applicable) that use each BRI line.

ISDN Keyword Descriptions

card_number — Apply the keyword to the board specified by the number. If only the card number (starting at 0) is specified, the keyword applies to all channels on the board. Use number 1 for BRI line (D channel) and 2 for *bearer_chan*.

bri_line
d_chan — Apply the keyword to the specified BRI line (D channel) on the specified board. If a BRI line (D channel) number is specified, the keyword applies to both (if applicable) bearer channels that use the BRI line (D channel).

bearer_chan — Apply the keyword to the specified bearer channel using the BRI line (D channel) on the specified board. Use number 1 for *bri_line* (D channel) and 2 for *bearer_chan*.

Note: If you do not include any card base address, BRI line, or bearer channel information, the keywords apply to all boards, all BRI lines, and all B channels.

If you begin a line with a #, the line is ignored.

The B channel in a BRI line is identified as a channel 1 or 2. Each BRI line has two B channels. These are used by two TR114 channels, but with no fixed correspondence between the B channels and the TR114 channels.

For example, if you have TR114 channels 0 - 3, specifying `bri_line 1` and `bearer_chan 1` indicates the first of the two TR114 channels using BRI line 1, which is TR114 channel 0;

- `bri_line 1` and `bearer_chan 2` indicate TR114 channel 1
- `bri_line 2` and `bearer_chan 1` indicate TR114 channel 2
- `bri_line 2` and `bearer_chan 2` indicate TR114 channel 3.

The TR114 channel that uses the D channel can have a value of 1 or 2, unlike the normal numbering of the TR114 channel that has a range of 0 - (N–1), where N is the number of channels. Each D channel corresponds to two B channels. These are used by two TR114 channels, but with no fixed correspondence between the B channels and the TR114 channels.

For example, if you have TR114 channels 0 - 3, specifying `d_chan 1` and `d_tr114_chan 1` indicates the first of the two TR114 channels using D channel 1, which is TR114 channel 0:

- `d_chan 1` and `d_tr114_chan 2` indicate TR114 channel 1
- `d_chan 2` and `d_tr114_chan 1` indicate TR114 channel 2
- `d_chan 2` and `d_tr114_chan 2` indicate TR114 channel 3.

Table 20 ISDN Parameters

Parameter	Definition	Valid Values
datalink	Specifies the ISDN data link type for a specific D channel.	Values: pmp (point-to-multipoint)(default) ptp (point-to-point) If ptp is specified, the TEI (terminal equipment identifier) value can be included.The default TEI is 0.
bearer	Selects the bearer capability for outgoing calls for a specific TR114 channel. When there is an *isdn.cfg* file used by the application, the bearer setting in *isdn.cfg* has priority at runtime.	Values: speech 31kaudio (default)
cpn	Specifies the calling party number for outgoing calls for a specific TR114 channel. If no number is entered, none are presented to the network. When there is an *isdn.cfg* file used by the application, the *cpn* setting in *isdn.cfg* has priority at runtime.	Value: blank (default) decimal number
local	Specifies the called party number that the board answers on incoming calls. This option cannot be used when performing DID routing. When there is an *isdn.cfg* file used by the application, the *local* setting in *isdn.cfg* has priority at runtime.	Value: blank (default) decimal number
bchan_sel	Specifies the preferred B channel to be selected for outgoing calls for a specific TR114 channel. Either B channel assignment is accepted in all cases. This parameter is also present in *isdn.cfg*, but has not been implemented in *isdn.cfg*.	Values: 0 = No B channel request is made 1 = Request for B channel 1 2 = Request for B channel 2 3 = Request for either B channel (default)

Table 20 ISDN Parameters (Continued)

Parameter	Definition	Valid Values
coding	Specifies the coding format used for a specific TR114 channel.	Values: alaw - for Europe (default) µlaw - for Japan
connect_ack	Specifies whether the board sends a Connect Acknowledge message in reply to every Connect message.	Values: no yes (default)

Sample configurations (only take effect after running `briconf -p bri.cnf`):

- For all channels on all boards, set the data link to point-to-multipoint and the bearer capability to 3.1k Audio:

  `datalink pmp`

  `bearer 31kaudio`

This example would configure all ports and boards in a system to use the point-to-multipoint datalink, and a speech bearer capability.

`datalink pmp`

`bearer speech`

- Set data link, bearer, B channel preference, and cpn parameters for the BRI lines on the first (card 0) and second card (card 1):

```
0 datalink ptp
1 1 datalink ptp 1
1 2 datalink pmp
bearer speech
0 1 1 bchan_sel 1
0 1 2 bchan_sel 2
0 2 1 bchan_sel 1
0 2 2 bchan_sel 2
1 2 1 cpn 123
1 2 2 cpn 456
```

- You can limit the scope to a particular card by specifying the card number, which starts at 0. The card numbering is in the same order/sequence as the IO addresses used by the multiple cards (so, the card with the lowest IO addresses, is the card 0). For example:

  0 datalink pmp

  1 datalink ptp

- Specify a particular ISDN port (BRI line/D channel) on a particular card:

  0 1 datalink pmp

  0 2 datalink ptp

  Sets port A to point-to-multipoint and port B to point-to-point.

- Specify some parameters per fax channel (associated to a particular D-channel). For example:

  0 1 1 cpn 123

  0 1 2 cpn 456

  sets the TR114 channel 0 of Port A to use the Calling Party Number 123 and channel 1 of port A to use 456.

- Set data link, bearer, B channel preference, and cpn parameters for the BRI lines on the first (card 0) and second card (card 1):

```
0 datalink ptp
1 1 datalink ptp 0
1 2 datalink pmp
bearer speech
0 1 1 bchan_sel 1
0 1 2 bchan_sel 2
0 2 1 bchan_sel 1
0 2 2 bchan_sel 2
1 2 1 cpn 123
1 2 2 cpn 456
```

Capturing Trace Information

You can use the *briconf* program to perform protocol analysis on the TR114 BRI board.The *briconf* utility captures the ISDN protocol trace information to the circular buffer.

1. Stop the application, but do not stop the driver (*bfax*).

Note: If *bfax* is stopped, you will need to restart it:

At a DOS prompt from the directory where *faxinit.exe* resides, run:

```
faxinit -n
```

2. At the DOS prompt from the directory where your *briconf.exe* resides, enter:

```
briconf -d c
```

3. Restart your application.
4. Send or receive faxes.
5. Stop your application again without stopping *bfax*.
6. Send the contents to the file, *britrace.txt*, as follows:

```
briconf -d e
```

The *briconf* utility automatically creates the file, *britrace.txt* in the same directory as the one in which your were working. The *britrace.txt* and *logxx.txt* files are very useful for Technical Support when diagnosing ISDN line problems.

Note: The *briconf* utility creates only one *britrace.txt* file. If you have multiple TR114 BRI boards in the same chassis, it is strongly recommended that you remove the ISDN BRI lines from the connectors on all boards but one. This will ensure that you will diagnose the ISDN connectivity for only one board at a time

Downloading BRI Firmware Updates

You can use the *briconf* program to download updated firmware to the ISDN daughter board.

For example, to download the firmware from the file, *bfw2_20.s*, enter:

```
briconf -f bfw2_20.s
```

D
Telephone Service Options

This appendix describes telephone service options and provides ordering and connecting information.

It includes the following sections:

- Loop-Start Telephone Service
- DID Telephone Service (DDI)
- ISDN Telephone Service

Loop-Start Telephone Service

Loop-start telephone service is the same service the telephone company installs in residences. One loop-start telephone line connects one telephone number to the local telephone company's central office or to a remote switching system.

Loop-start service is the most common form of analog line service, in which a line is seized (started) with a supervisory signal (taking the phone off the hook) by bridging both wires of the phone line (tip and ring).

Ordering Loop-Start Telephone Service

For simple loop-start service, you must obtain the following from the telephone company:

- One loop-start telephone line for each TR114 loop-start interface (channel). (One line for a one-channel board; up to two lines for a two-channel board; up to four lines for a four-channel board.)
- One USOC-RJ-11C wall jack for each telephone line.

  Make sure the telephone number or extension number is clearly marked on the cover of each jack.

For PBX or Key telephone systems, you must obtain the following from the PBX administrator:

- An analog single-line extension for each loop-start interface. An analog single-line extension provides service compatible with telephone company loop-start trunks.

  Note: If you use a telephone system extension, make sure it is an analog single-line extension, not a digital extension.
- A telephone system feature, such as DIL (Direct Inward Line termination), to provide outside callers direct access to the TR114 extension.
- One USOC-RJ-11C wall jack for each telephone line.

Connecting to Loop-Start Telephone Service

To connect loop-start channels from your TR114 to loop-start lines:

1. Locate the cable supplied with the TR114 board.
   - The single line cable is for the one-channel board.
   - For two-split cables, the wires are labeled A and B
   - For four-split cables, the wires are labeled A, B, C and D.

   Note: If you make your own splitter cables, to ensure a stable connection use an RJ-45 plug on the end of the cable that plugs into the RJ-45 jack on the TR114.
2. Plug the end with a single RJ-45 plug into the RJ-45 jack on the board.
3. Plug the RJ-11 plugs at the other ends of the cable into separate loop-start jacks.

The table below shows the relationship between the channels and the cables:

Table 21 TR114 Channels and Cables

TR114 Model	TR114 Channel	Cable Labels
P1L	0	A
P2L	0	A
	1	B
P4L	0	A
	1	B
	2	C
	3	D

- Single-channel boards use channel 0
- Two-channel boards use channels 0 and 1
- Four-channel boards use all channels

The TR114 loop-start channels are now connected to the loop-start telephone lines.

DID Telephone Service (DDI)

DID stands for Direct Inward Dialing and is used interchangeably, although not precisely, with DDI (Direct Dialing Inward). DID is actually analog terminology and is used in the United States for both analog and digital services, while DDI is prevalent in Europe. In this form of telephone service, a caller can dial inside a company directly without going through an attendant or autoattendant. This is a common type of business telephone service on analog lines. It is primarily used in the United States.

DID lines support incoming calls only. More than one telephone number is assigned to a pair of wires. DID analog service can enable automatic routing of faxes to the proper destination within a multiuser fax system.

For example, Company ABC is assigned one DID trunk that is composed of one hundred telephone numbers ranging from 239-9400 to 239-9499. When any one of the numbers in this range is dialed, the telephone company seizes the trunk and transmits the last few digits (usually 3 or 4) of the dialed number to the TR114. By detecting these digits, the TR114 can tell which of the hundred numbers was actually dialed.

If the trunk is busy, callers to any of the other numbers encounter a busy signal. Because of this situation, many fax messaging systems require more than one DID trunk to which the range of DID telephone numbers is assigned. The number of trunks required depends on the traffic demands on the system.

Since DID trunks are one-way (inward), a two-way fax messaging system using DID requires one or more loop-start telephone interfaces for sending facsimiles.

DID Operation

When a person or a fax machine dials a number connected to a TR114 DID channel, the telephone company (telco) seizes that number's line, causing loop current to flow through the board. The board detects the loop current and recognizes it as an incoming call. The next step depends on how the DID line has been configured – with wink-start (the most common configuration) service, or with immediate-start service.

On a line configured for wink-start service, the board momentarily reverses the voltage polarity applied across the phone line after it detects seizure of the line. The reversal (a wink) signals the telco that the line is ready to receive the last few digits of the dialed number. The telco transmits these digits to the board with DTMF signals (or in some cases with pulse signals). You must inform the telco of the number of DID digits you want the them to transmit.

When the TR114 board has detected all of the DID digits, it reverses the polarity across the phone line again, signaling the telco that it has accepted the call. If the board does not detect the correct number of DID digits, it plays a fast busy signal.

On a line configured for immediate-start service, the board does not perform a wink. Instead, the telco waits a fixed amount of time after seizing the line before it sends the DID digits to the board. Then, when it detects or fails to detect the correct number of DID digits, the board responds the same as it does when configured for wink-start service.

DID Answer Supervision Signaling

In compliance with FCC DID registration, Brooktrout includes the following information regarding TR114 models I2C, I2D, I4C and I4D for the customer:

1. Allowing this equipment to be operated in such a manner as to not provide proper answer supervision signaling is in violation of FCC Rules, Part 68.
2. This equipment returns answer supervision signals to the PSTN when 1) Answered by the called station, 2) Answered by the attendant, 3) Routed to a recorded announcement that can be administered by the CPE user, and 4) Routed to a dial prompt.
3. This equipment returns answer supervision on all DID calls forwarded back to the PSTN. Permissible exceptions are: 1) A call is unanswered, 2) A busy tone is received, or 3) A recorder tone is received.

Ordering DID Telephone Service

The following specifications are for direct connection using a wall jack. If you will be connecting through a PBX, check with your PBX support person to see if your PBX supports DID service.

For DID service, you must obtain the following from the telephone company:

- One DID telephone trunk for each TR114 DID interface.
- A block of telephone numbers (usually 100 or 1000 numbers per block) associated with the trunk.

For DID telephone service, a power supply must be installed and running on the TR114 before the telephone company can activate a DID line. Once the DID line is activated, –48 Vdc power must be continuous, or the telephone company might disconnect the DID service.

You must provide the telco with a specification of the DID service options you want.

DID Service Options

Before you order DID service from your telephone company, you need to find out what DID service options are available in your area and decide which options you want. These service options define how your DID service operates.

DID service options include:

Service type	**Wink-Start**/Immediate-Start
Signaling type	**DTMF** (Touch-Tone)/Pulse
Number of digits	Three/**Four**
Trunk Type	**Loop start** (2-wire)
	Ground Start (4-wire) Not supported

The options listed in **bold** type are the values set in the default configuration file supplied with the board.

Note: After you know what service options are available, you must specify the service type and number of digits in your software configuration file (in the Brooktrout API, it is the *btcall.cfg* file).

Service Type

The TR114 supports both wink-start and immediate-start service. Brooktrout recommends wink-start service because it is faster and less prone to errors than immediate-start service. The following table describes the difference between wink-start and immediate-start service.

Service Type	Interdigit Delay Time
Wink-Start	The TR114 expects to see the first DID digit within 5 seconds after the telephone is activated. Each successive digit must arrive within 5 seconds of the previous one.
Immediate-Start	The TR114 expects to receive the first DID digit within 18 seconds after the telephone is activated. The maximum interdigit delay is 18 seconds. This service type might be easier to use for hand-dialed testing.

If immediate-start is the only service available from your telephone company, consult the documentation supplied with your software for information on how to support it.

Signaling Type

The signaling type can be pulse or DTMF (touch-tone).

- Pulse signals are those generated by rotary-dial telephones.
- DTMF tones are those generated by touch-tone telephones.

The TR114 generates and detects DTMF and pulse signals automatically, so you do not specify them through software.

Number of Digits

DID analog service sends the last few digits of the dialed telephone number to the TR114 as a routing address. You must specify the number of DID digits the TR114 expects to receive to the telephone company and in the software.

Trunk Type

The trunk type options are loop-start 2-wire DID and ground-start 4-wire DID. Brooktrout only supports 2-wire loop-start DID.

Connecting to DID Telephone Service

After you have installed the TR114 DID board in the computer and connected a DID power supply to the board, you can connect the TR114 to DID telephone service. If you need more information about DID service and how to order it, see *Ordering DID Telephone Service* on page 102.

Connect your TR114 telephone cables using the following procedure:

1. Locate the cables supplied with your TR114. The provided two-split cables are labeled A and B.

Note: If you make your own cable, to ensure a stable connection, use an RJ-45 plug on the end that plugs into the RJ-45 telephone jack on the TR114.

2. Plug the end with a single RJ-45 plug into the RJ-45 jack on the TR114 mounting bracket; plug the RJ-11 plugs at the other end into wall-mounted DID phone jacks.

Do not plug a DID cable into a loop-start line. This can cause serious damage to the TR114.

The TR114 DID channels are now connected to the DID lines.

The following table shows how the TR114 channels connect to DID telephone service.

Table 22 TR114 Channel Connections to DID

TR114 Model	Channel Number	Cable Label	Service Type
P2D	0	A	DID
	1	B	DID
P4D	0	A	DID
	1	B	DID
	2	C	DID
	3	D	DID
P2C	0	A	Loop-start
	1	B	DID
P4C	0	A	Loop-start
	1	B	Loop-start
	2	C	DID
	3	D	DID

ISDN Telephone Service

The ISDN Basic Rate Interface (BRI) provides dial-up digital access to the worldwide telecommunications network over twisted-pair telephone lines. BRI supports single (point-to-point) or multiple (point-to-multipoint) ISDN terminal devices on an individual line.

BRI service provides end-to-end digital connectivity to support a wide range of telecommunication services. These services include voice and non-voice services which customers can access using a small set of standard user-network interfaces.

BRI provides two B (bearer) channels and one D (signaling) channel, often referred to as 2B+D. The B channels carry circuit-switched voice or data at 64 kbit/s, and the D channel carries call control signaling at 16 kbit/s. The channels are connected to telephone service using an RJ-45 connector on the board.

BRI ISDN allows you to do inbound call routing. It is primarily used in Europe and Japan.

Ordering ISDN Telephone Service

When you order Euro-BRI service from the telephone company or PBX vendor, give the representative the following information:

Manufacturer	Brooktrout Technology
Product name:	TR114 Series board
Type of line:	Basic rate, aka S9, T0, S2
Type of interface:	S/T, not U
Signal protocol:	EuroISDN, aka CTR-3, DSS1, Q.932; not 1TR6, DASS2 or DPNSS
Clock master:	Network side must be configured as “NT”, and provide the clock
Number of ISDN Ports:	One port equals two B channels; depends on model of TR114 board
B Channel Provisioning:	Circuit-Switched Data (CSD)
Channel service:	64 kbit/s clear channel service end-to-end for every call
Call distribution:	Linear recommended
Datalink protocol:	Point-to-multipoint (default) and point-to-point are both supported; configure the TR114 based on how the telco provider has the BRI line configured

If you are doing inbound routing, request a called party number. Keep layers 1 and 2 active. Do not request a specific HLC such as “telephony”.

Connecting to ISDN Telephone Service (BRI Boards)

When you have set up the board and inserted it into your computer, you can connect the telephone cables to the ISDN telephone service.

For each port, the installation requires one cable consisting of two twisted-pairs (four wires) to provide the connection between the TR114 ISDN board and the network termination equipment (NT1).

Whenever you open the host equipment, disconnect the ISDN cables before accessing the ISDN board.

TR114-to-ISDN Channel Connections

TR114 channel numbers start at 0. For four-channel TR114s, the channel numbers are 0, 1, 2, and 3. The two ISDN lines are identified as BRI A and BRI B. For two-channel TR114s, the channels are 0 and 1; the single ISDN line is BRI A. Refer to Table 23 for the mapping of channel to RJ-45 jacks on the board.

Table 23 Channel and RJ-45 Jack Relationship

TR114 Channels	ISDN Line
0,1	BRI A
2,3	BRI B

Cabling to the Network Termination Equipment

You can connect a TR114 board to the network in one of the following ways:

- Direct connection to an NT1
- Indirect connection to an NT1
- Connection through an ISPBX

These connection types are described in the following sections.

Direct Connection to NT1

Figure 7 shows the wiring for an installation in which a TR114 BRI board connects directly to the locally mounted network termination equipment (NT1). The 4-wire cables included with your TR114 provide the proper wiring for ISDN connection. For this setup, connect the TR114 to the NT1 with the supplied cables. The telco installs the wiring on the other side of the NT1.

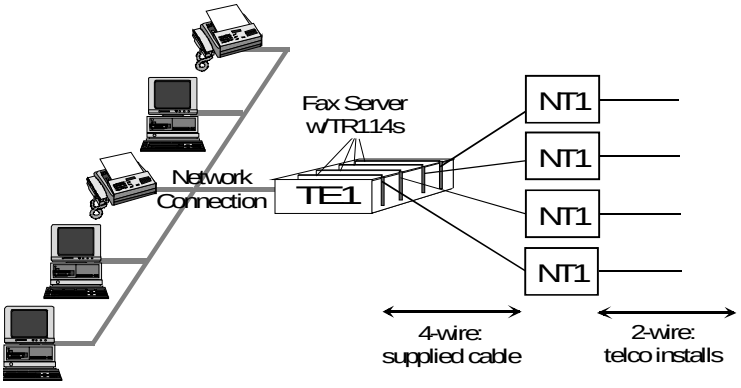


Figure 7 Direct Connection to NT1

Indirect Connection to NT1

Figure 8 shows a TR114 ISDN board installed in a different location than the network termination equipment (NT1). In this setup, you connect the TR114 to an RJ-45 wall-mounted telephone jack which is connected to the NT1. The telco installs the wiring on the other side of the NT1.

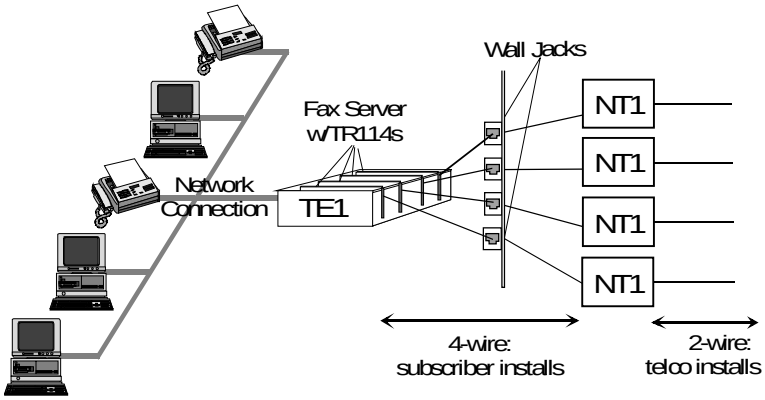


Figure 8 Indirect Connection to NT1

For an indirect connection to the NT1, you might have to modify the wiring at your site before you connect the TR114 to ISDN service. As the subscriber, you are responsible for installing and maintaining all wiring connecting your terminal equipment to the NT1.

Wiring for Indirect Connections

To support an indirect connection, install a cable with two twisted pairs (providing four wires) between the RJ-45 jack on the TR114 and the NT1 or ISPBX. Refer to the instructions provided by your NT1 or ISPBX vendor for the cable specifications.

If your TR114 does not connect to a locally mounted NT1 with a short cable, the ISDN interface must be terminated at the wall jack. If the wall jack is not terminated, then you must use the ISDN termination adapter (see Figure 9) supplied with the TR114:

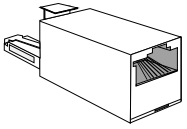


Figure 9 ISDN Termination Adapter

Connection through ISPBX

Figure 10 shows a LAN fax network connected to the public ISDN network through an ISPBX. In this setup, the TR114 board connects through a wall jack to an ISPBX extension line, and the ISPBX connects to the NT1.

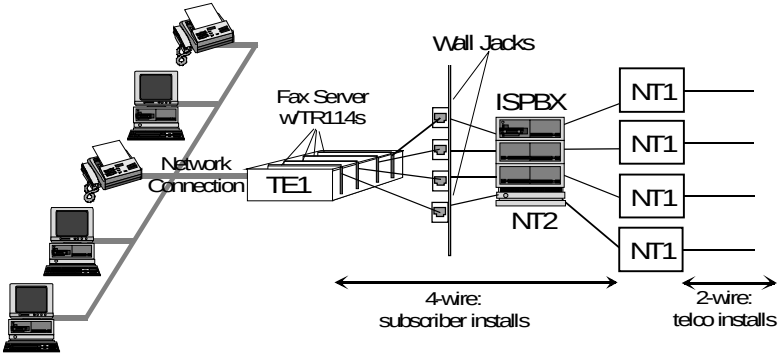


Figure 10 Connection through ISPBX

Checking for Wall Jack Termination

To see whether a wall jack is terminated, follow the steps below.

1. Remove the wall jack from its wall mount and turn it over to expose the contacts and wiring (Figure 11):

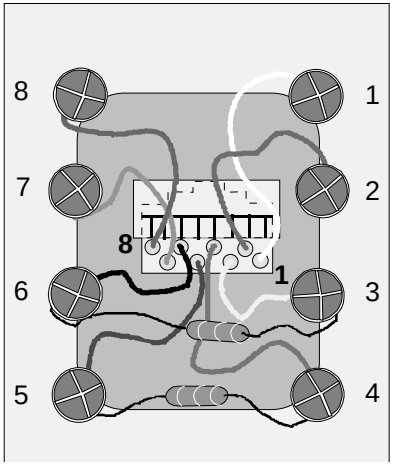


Figure 11 Terminated RJ-45 Wall Jack

   a. If the jack is terminated, you will see two 100-ohm ±5% resistors attached to wire pairs on the back of the jack like that shown in Figure 12:

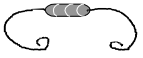


Figure 12 100-ohm ±5% Resistor

   b. If the jack is not terminated, you must attach an ISDN termination adapter to the cables when you plug them in.

2. Replace and secure the wall jack in its wall mount.

Plugging Telephone Cables into the Wall Jack

To connect your TR114 board to ISDN service, plug in the cables as follows:

1. Locate the telephone cable(s) supplied with the TR114.
2. Plug the telephone cable(s) into the RJ-45 telephone jacks on the TR114 (see Table 23 on page 109 for channel connections).
3. Plug the opposite end(s) of the cable into the wall jack as follows:
   a. If the wall jack is terminated, plug the opposite end of the cable into it directly.
   b. If the wall jack is not terminated, plug the opposite end of the cable into a termination adapter supplied with the TR114, then plug the termination adapter into a wall jack.
4. Your TR114 is now connected to ISDN service. Mark the telephone number, or extension number, on the cover of each wall jack. This aids in maintenance procedures later.

Connecting to a PABX

This section is intended for resellers connecting the ISDN TR114 behind a PABX. See *Troubleshooting ISDN Installations* on page 120 for supplementary information.

The bulk of the section provides generic information suitable for all PABX installations. It acts as an installation framework and has paragraphs targeted to the reseller and PABX Engineer. These paragraphs provide Brooktrout ISDN TR114 detail and highlight information to be exchanged between the reseller and PABX Engineer.

Recommendations Before Installing

For the reseller

Ideally the following is required:

- Experience installing and configuring ISDN TR114s
- Copy of the TR114 Universal PCI Board Installation Guide
- DOS Boot disk
- Copy of the “Configuration and diagnostics CD”
- Access to a telephone near the Fax server
- On-site internet/FTP access
- Hand-held ISDN tester, such as an AuroraPlus Combi (www.trendcomms.com)
- Brooktrout contact information

For the PABX Engineer

Ideally the following:

- Experience configuring the PABX for different ISDN equipment, or ability to contact someone with thorough knowledge of ISDN protocol for your PABX
- Portable ISDN tester

Installation

For the Reseller

Provide the following information to the PABX Engineer:

- Number of ISDN ports you require. (One for every two fax/voice TR114 channels.)

  If you require more than one ISDN port, indicate which method of call distribution you desire, linear or cyclical.

Linear	Calls are always placed on the same channel, and 'roll over' to other channels only when that one is busy. If a problem exists, linear distribution is recommended because it is easier to troubleshoot.
Cylical	Calls are shared amongst the channels, by placing each new call on the next channel in the group.

- Whether or not the PABX needs to present a Called Party Number.

  If the ISDN TR114 is to be used for inbound routing of faxes, then the PABX needs to present all or part of the number dialed by the fax sender, in order to identify the recipient.

- The quantity and range of DID (DDI) numbers you require.

  For example, you could tell the PABX Engineer that you require:

  - Two ISDN ports
  - Linear call distribution
  - Ten DID numbers from 555100 to 555110

  The PABX needs to present a Called Party Number

  Before the PABX Engineer arrives to configure the PABX, you should ensure that the Engineer is experienced with ISDN installations, and brings an ISDN tester to the site.

  The PABX Engineer should check the ISDN requirements detailed in the next section, and confirm to you that the PABX is capable of matching each and every one of these requirements.

For the PABX Engineer

The Reseller provides you with certain information, including:

- Number of ISDN ports
- Call distribution (Linear/cyclical)
- Quantity and range of DID numbers
- Whether they require a Called Party Number to be presented

This section provides detailed information regarding the ISDN requirements of the Brooktrout ISDN TR114. The information is presented in technical detail on a layer-by-layer basis. You should ensure the PABX is configured to meet these requirements.

General

- EuroISDN protocol stack, also known as DSS1 or ETSI 300 (*not* 1TR6 or DASS2). Basic Rate access.

  The PABX port should be a Network Termination (NT or master) since the TR114 is Terminal Equipment (TE or slave).

Layer 1 – Physical Layer

- ITU I.430 Standard, four wire (two pair) S/T RJ45 interface.
- Port should be terminated in 100 Ohms.

  The ISDN TR114 does not require any optional supplemental power. Ideally, the physical layer remains active between calls for speed, but this is not necessary.

Layer 2 – Datalink Layer

- Q.921 Standard

  The ISDN TR114 can use either point-to-point or point-to-multipoint datalinks. Ideally, the datalink layer remains active between calls for speed, but this is not necessary.

Layer 3 – Network Layer

- Q.931 Standard

  For maximum flexibility, bearer capabilities of Speech and 3.1K Audio should be acceptable for both incoming and outgoing calls.

  The ISDN TR114 can be configured to present a Calling Party Number.

  Note: Most installations require the PABX to provide a Called Party Number. The reseller should have indicated to you if this is required. The Called Party Number does not need to be the full number dialed, merely enough trailing digits to uniquely identify a called user. Although the quantity of received digits is usually fixed, the ISDN TR114 can accept a variable number of digits.

  The Called Party Number should be presented in one of the following ways:

En-Block	As a Called Party Number or a Redirecting Number Information Element within the initial SETUP message
Overlapped	As Called Party Number Information Elements, distributed within the initial SETUP message and subsequent INFO messages.

  Note: The ISDN TR114 has a number of ISDN protocol specific parameters, which can be configured. These should generally be left at their defaults. In cases where you are experiencing problems during the installation, and you have a good understanding of the ISDN protocol used by your particular PABX, it might be useful for the reseller to show you this list of parameters, their range and their defaults. This information is documented as the ISDN configuration file in Table 19 on page 85.

You should now indicate to the reseller:

- Whether the datalink is point-to-point or point-to-multipoint
- If your PABX requires the ISDN TR114 to present a Calling Party Number
- Exactly how many digits are present in the Called Party Number
- Any deviations from the requirements listed above
- Prior to connecting the ISDN TR114, you should use your portable ISDN tester to demonstrate to the reseller that both ISDN channels can originate and receive calls. You should also demonstrate that when receiving calls, the Called Party Number is presented.

For The Reseller

The PABX Engineer should have demonstrated operation of the line. If not, you should test the line using your own ISDN tester.

The PABX Engineer should have indicated:

- Whether the datalink is point-to-point or point-to-multipoint
- If the PABX requires the ISDN TR114 to present a Calling Party Number
- Exactly how many digits are present in the Called Party Number by the PABX
- Any deviations from the listed requirements

You can use this information to set the following parameters:

- Datalink and, optionally, others such as CPN, etc. in *bri.cnf*
- *did_digits* and *did_variable* in *btcall.cfg* (*user.cfg*)

You should configure the board, and test the installation using the diagnostics found on the Brooktrout website. Testing procedures are fully documented in Chapter 2, *Testing*, on page 9.

Troubleshooting ISDN Installations

Important Network Characteristics

ISDN Line characteristics	One ISDN interface is required for every two fax channels. A single standard basic rate line provides two channels called bearer (or B) channels that can be used simultaneously for both incoming and outgoing calls. Call control for both of these channels is provided over a single, shared D channel. These three channels are multiplexed together onto 4-wires providing the so called 2B+D Basic Access. These 4 wires terminate in a single RJ45 (EN 28877) connector, referred to as the S/T ISDN interface.
Datalink protocol	The most important variable in an ISDN installation is the protocol used for establishing a datalink between a piece of TE (Terminal Equipment) and an NT (Network Termination). There are two types of connection, point-to-point and point-to-multipoint. The user rarely has a choice over the type of datalink.
Point-to-point	This datalink is intended to connect a single piece of TE (such as a TR114) to a NT. The ID which is referred to as the TEI (Terminal Endpoint Identifier), is used to identify or address all data packets and is fixed - usually to Zero. This datalink is NOT provided by the PTT in France or the UK.
Point-to-multipoint	This datalink is intended to connect multiple TEs to a single NT. Up to 8 devices can physically be connected to the same ISDN bus. Any of the connected TEs can be given a free B channel to place a call. Incoming calls are broadcast to all connected TEs, and often the TE is programmed to answer only calls destined to a specific number, by specifying a local address. The ID, or TEI cannot be fixed at zero (as in point-to-point), because multiple TEs need to be addressed. All TEs on the ISDN bus are expected to participate in automatic TEI procedures in order to request a TEI (or address) from the network, before a datalink can be established.
Service indicator (Bearer Capability)	When placing a call, a TE presents certain characteristics of itself in order to request a certain bearer capability of the network, and to allow a receiving device to establish if it is compatible with the

sender before answering the call. Two important bearer capabilities are speech and 3.1k Audio. Speech specifies the lowest level of service, and is the bearer capability used by telephones. The bearer capability of 3.1k Audio is recommended by the appropriate standards for fax group 2/3. A bearer capability set to 3.1k Audio ensures a higher quality of line than guaranteed by speech. However, some public and private networks do not correctly handle 3.1k Audio bearer capabilities and might reject the call.

Receiving DID digits

There are two ways the NT can pass the DID digits to a TE, en-block and overlapped. In the vast majority of installations the DID number is passed en-block, where the whole number is passed in a single group. Some networks pass the DID digits overlapped, where the DID digits are received fragmented in separate messages.

Overlapped receiving is only found under the following circumstances:

- Countries where the public network can allow a user-defined variable number of subaddress DID digits, such as Germany, Austria and Italy.
- When the supplemental service is DID, and the datalink is point-to-point.
- When the caller is dialing using overlapped sending.

General PABX

The quantity of numbers available from a PABX, and the datalink protocol used, varies according to many parameters including the PABX make, model, version, configuration and country of installation. The accompanying FAQs might help in specific installations.

Calling Party Number

Some PABX require that the TE present a Calling Party Number for outgoing calls to enable the PABX to verify that the TE placing the call is valid. This is only an issue on point-to-multipoint datalinks.

ISDN Supplementary Services

Subaddressing (SUB)

Recommended for LAN fax networks of any size, SUB enables direct routing of incoming faxes to individual workstations or printers attached to the LAN fax network.

In some regions, a variation of this service is sometimes included in basic BRI service at no additional cost and is often available with both Multiple Subscriber Numbers (MSN) and Direct Inward Dialing (DID). It enables subscribers to expand their addressing capacity significantly beyond that provided by the ISDN directory number.

Note that for fax calls originating on the Public Switched Telephone Network (PSTN), subaddressing requires specialized support. The PSTN must accept and carry dial strings that contain both the directory number and the additional subaddress characters. Also, either the PSTN or the ISDN network must convert the entire dial string into ISDN format for delivery to the TR114.

The LAN fax network administrator must associate each of the workstations on the network with a valid subaddress. Subaddresses are coded in two formats, Network Service Access Point (NSAP) format and a user-defined format:

- NSAP coding follows CCITT and ISO standards. It uses the first character in the subaddress to indicate the format, leaving the remaining characters for addressing.
- For the user-defined format, users on both sides of the communications link must know the coding.

The network administrator must include format information when associating each workstation with its subaddress, and callers must include it in the dial string.

The maximum number of characters permitted in subaddresses varies across telephone service providers, but twenty characters is typical and provides support for an almost unlimited number of workstations.

For incoming calls, the telephone company includes the full ISDN directory number and subaddress as the called party number in the SETUP message. When the TR114 channel answers a call, it captures the subaddress and passes it to the LAN fax application on the host, which routes the fax to the workstation on the network associated with that number.

Number Provisioning

In most installations, a range of numbers assigned to one or more ISDN ports in order to perform inbound routing is required. There are two common PTT supplied services, Multiple Subscriber Numbering (MSN) and Direct Inward Dialing (DID).

Multiple Subscriber Numbering

Recommended for small LAN fax networks with eight or fewer workstations.

MSN enables direct routing of incoming faxes to individual workstations or printers attached to the LAN fax network.

This service is usually available only on individual ISDN lines. It assigns a block of telephone numbers (usually eight to ten) to an ISDN line and is specifically for the point-to-multipoint datalink. For example, if 8 numbers are assigned to a single ISDN line, using the point-to-multipoint datalink, the TR114 answers all calls directed to any of the 8 numbers, and passes the number to the application for routing. These telephone numbers are not necessarily consecutive.

The LAN fax network administrator must associate each of the workstations on the network with one of the telephone numbers in the assigned block of MSN numbers.

For incoming calls, the telephone company includes the full MSN number as the called party number in the SETUP message. When the TR114 channel answers a call, it captures the MSN number and passes it to the LAN fax application on the host, which routes the fax to the workstation on the network associated with that number.

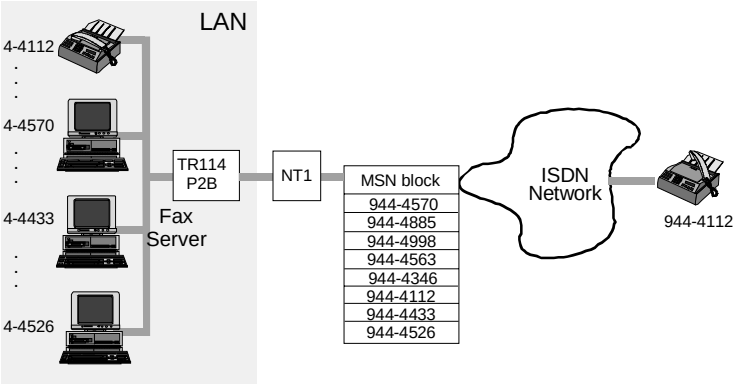


Figure 13 Typical MSN Configuration

Direct Inward Dialing

Direct Inward Dialing (DID) or Direct Dialing Inward (DDI) is recommended for larger LAN fax networks with ten or more workstations. It provides an unlimited range of numbers, usually purchased in blocks from the PTT. It is usually available only on point-to-point datalinks, excluding the UK and France as previously mentioned.

In some countries, it is possible to specify how many of the trailing digits are sent as the Called Party Number to the TE when a call is placed. For example in the UK or Portugal you could specify that you require the last 4 digits.

DID enables automatic routing of facsimiles to distinct workstations or printers attached to the LAN fax network.

LAN fax systems large enough to warrant DID service often warrant line hunting service also (see *Multiple Access/Line Hunting (MA/LH)* on page 127). If line hunting is included with DID service, the telephone company searches across a group of ISDN lines for a free B channel on which to deliver an incoming call.

This service is usually available only on groups of two or more ISDN lines. It provides a range of consecutive telephone numbers. Some telephone companies offer DID ranges in blocks of 10, 100, 1,000, and 10,000 numbers.

DID numbers consist of two parts: an access code that identifies the DID subscriber and an extension number that identifies the individual user. The length of the extension number usually depends on the size of the DID range and on subscriber requirements, but it is fixed for the subscription and registered in the public ISDN network.

The LAN fax network administrator must associate each of the workstations on the network with one of the telephone numbers in the assigned range of DID numbers.

For incoming calls, the telephone company includes the called party number in the SETUP message. The called party number might be the full DID number or the last one to five digits of the DID number. When the TR114 channel answers a call, it captures the DID number and passes it to the LAN fax application on the host, which routes the fax to the workstation on the network associated with that number.

This service is intended for all other general purpose number provisioning, such as in PABX.

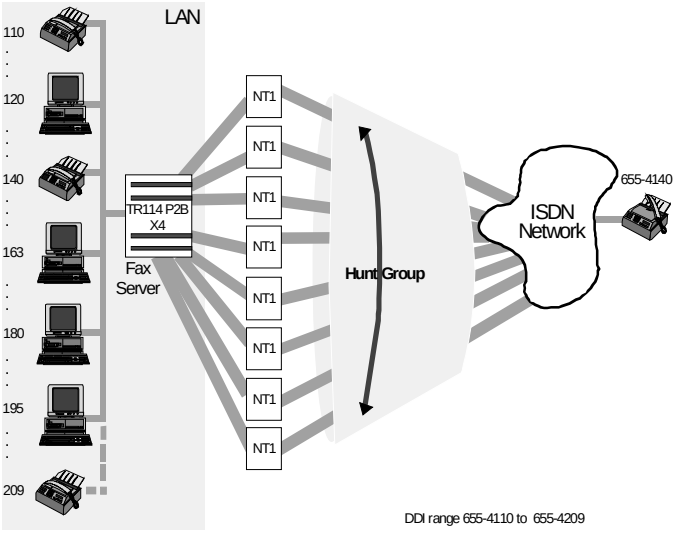


Figure 14 Typical DID Configuration with Line Hunting

Line Hunting

A service provided by many PTTs and PABX is the ability to share a pool of numbers across a number of ISDN ports. Calls are routed to the first available free port. There are usually two call placement strategies, linear and cyclical. In linear line hunting, all incoming calls initially are placed to the same port. In cyclical line hunting, incoming calls are rotated across all ports in the group. Cyclical hunting is intended to balance the load across the ports, but it can make troubleshooting difficult.

Multiple Access/Line Hunting (MA/LH)

This service is usually available only on groups of two or more ISDN lines. It combines several physical ISDN lines into one logical access, which can be reached through any telephone number in the range of assigned DID telephone numbers.

When you order MA/LH service, you might have to select and define the following subscription options:

- Subroutes
- Subroute Type
- Hunt Method
- Hunt Order

Subroutes

A subroute is a logical access made up of multiple ISDN lines. All lines in a subroute share the same configuration (subroute type, hunt method, hunt order, transmission characteristics, DID access code, and so on).

A subscriber site can have more than one subroute, but all subroutes share the same DID access code (see Direct Inward Dialing on page 125).

Subroutes can include an unlimited number of ISDN lines, but most telephone companies recommend limiting the number of lines to fewer than 100 for hunt groups when the hunt method is sequential or cyclical (see *Hunt Method* on page 128).

A hunt group is a subroute on which incoming calls can be delivered. By definition, only subroutes of type incoming or two-way are hunt groups. When searching any hunt group, the telephone company uses the group's predefined hunt method and hunt order to find a free B channel on which to deliver a call.

Subroute Type

Designates the direction in which calls are passed over a particular subroute. The options are:

- Incoming: The subroute carries incoming calls only.
- Outgoing: The subroute carries outgoing calls only.
- Two-way (recommended): The subroute carries both incoming and outgoing calls.

Hunt Method

Designates the method the telephone company uses to search for a free B channel on which to deliver a call.

Sequential

The accesses (lines) in the hunt group are ordered in a chain with a first and last member. Hunts always start at the first member and continue sequentially until encountering the last member, or a free B channel.

Preferred for two-way hunt groups connecting to an ISPBX when the access chains in the ISPBX and ISDN network are structured in opposite directions. This configuration reduces the risk of call collision.

Uniform

Hunts always search for the member that hasn't delivered an incoming call for the longest period of time.

Cyclical

The accesses (lines) in the hunt group are ordered in a circular chain. Hunts start with a randomly chosen member or the member following the last member on which an incoming call was placed and continue in sequential order until encountering the starting member, or a free B channel.

This method is preferred in most cases because it reduces traffic handling problems that temporary failures generate.

Hunt Order

Defines the order in which hunt groups are searched. Either incoming hunt groups are searched before two-way hunt groups or vice-versa.

Advice of Charge (AOC)

It is possible to obtain the cost of a call as a supplemental service within ISDN. There are two forms of advice of charge: advice of charge during the call (AOC-D), and advice of charge at the end of the call (AOC-E).

Advice of charge - during

Billing information is provided by the network throughout the active phase of the call. The information is provided as subtotals, and a final total is presented at the end of the call.

Advice of charge - end

Billing information is only presented as a total at the end of the call. The billing information is delivered in two types: units and currency.

Units:

A unit value is returned, where each unit has a pre-defined value. This type of billing information has a simple structure with few options.

Currency:

The actual cost of the call is returned, including currency identifiers and multipliers. This type has a complex structure with many options, and can vary from country to country.

AOC-D is the most common form of AOC, because it is used in most PABX installations. Many PABX can also provide this AOC information to their EuroISDN ports. Unit is the most common type, since it mirrors earlier analog billing methods, and has a simpler structure than currency. The structure of currency type varies from country to country.

Note: Although the board can interwork with all the varieties of AOC, if there is a choice available, we recommend AOC-D with unit type. This is because it is more widely available, premature disconnections result in a partial value, implementation does not vary widely, and it requires simple application support.

Configuring the Board

Installation of the board is achieved in much the same way as the analog TR114. The board can be configured to match the differing characteristics of the ISDN environment using the general configuration file *btcall.cfg* and the *briconf* configuration utility. See Appendix C, *Configuration Files*, on page 71 for additional information.

Configuration and Diagnostics CD

Some of the ISDN parameters are programmed onto the board once only. Others are sent to the board from the configuration file at run time. You can use the configuration and diagnostics CD to set up the once-only parameters using *briconf*, and to obtain and check the run time parameters for the general configuration file (*user.cfg*/*btcall.cfg*).

Once these run time parameters have been determined, their values can be used to configure the application program. The driver must be loaded (*btdriver.cnf*) prior to use of *briconf*.

Configuration file btcall.cfg (user.cfg)

The configuration file *btcall.cfg* can have a different name when supplied with some applications. For example with the DOS *faxtest* program, the file is called *user.cfg*. Within the configuration file *btcall.cfg*, there are three keywords of importance: *country_code*, *did_digits* and *did_variable*.

country_code

If the system is ISDN only, then the *country_code* should be set to the US default of 0010. If a system has both ISDN and analog boards, the *country_code* keyword in *btcall.cfg* should be set to match the analog board.

did_digits/did_variable

If you expect a fixed number of digits in the called party number, you should set the *did_digits* keyword in *btcall.cfg* to the total number of digits you expect to receive.

The exact interpretation of *did_digits* depends upon whether or not you are in receipt of overlapped receiving.

Overlappped receiving

If you are in receipt of overlapped receiving, as you might be if you are in Germany, Austria or Italy, the *did_digits* keyword should be set to the total number of DID digits you expect to receive. If the number of digits you expect to receive is variable, you should set the *did_digits* value to the maximum you could receive, and set the *did_variable* keyword to 1. Under such variable digit conditions, the board operates with a 5 second interdigit timeout.

En-block

If you are not in receipt of overlapped receiving, which applies to most installations, *did_digits* has the following interpretation. If *did_digits* is set to a value less than the expected number of DID digits, the trailing digits are returned. For example, if the network

sends 1234567 as the called party number with *did_digits* set to 3, the board returns 567 to the application. In the previous example, if *did_digits* were set to 7, then 1234567 would be returned.

It is important that *did_digits* should not be set to a value greater than the number of expected DID digits with *did_variable* set to zero. The reason for this is that the board waits 16 seconds for the number of digits specified in *did_digits*, then it rejects the call, issuing 80 28 (User - Invalid number format) as the cause for the disconnection to the sender. In addition, a `debug_data` string is reported in the debug output to log the event. The following example shows that an incoming call was received and rejected. The incoming call had 3 digits, and *did_digits* had been set to expect more.

Sample debug_data

```
11/10 13:23:45.37 0 intr: 0x14 DEBUG_DATA 0x0

11/10 13:23:45.37 0 Debug string: An incoming call
has been detected with 3 digits in Called Party
Number

11/10 13:23:45.37 0 intr: 0x14 DEBUG_DATA 0x0

11/10 13:23:45.37 0 Debug string: An incoming call
has been detected with 0 digits in Redirecting Number
```

Frequently Asked Questions

Q) What is the daughtercard firmware?

The ISDN card has two types of firmware: the usual TR114 firmware, and some additional daughtercard firmware.

The regular TR114 firmware (*.*pex*) is lost whenever power is removed from the board, and is downloaded to the channel when it is first reset by the application. This is required for all versions of the TR114. Versions 1.80 or above are required for use with the ISDN TR114.

The ISDN TR114 has additional ISDN firmware which interfaces the TR114 firmware to the ISDN network. The difference between the ISDN firmware and the TR114 firmware is that it remains on the board even when power is cut off. Daughtercard firmware downloads are only required when Brooktrout update the firmware.

Q) What firmware versions do I need?

Brooktrout would recommend the use of TR114 firmware versions 1.8a and daughtercard firmware version 2.00 or above. Customers in receipt of overlapped receive DID, or who require advice of charges, should contact their local technical support for firmware details.

Q) What are the small connector blocks supplied with the boards? Do I need them?

The connector blocks (usually grey or white) are terminating resistor packs, and plug directly into the connectors on the board. They are provided for use on point-to-point physical configurations, or on multipoint when no other TEs are terminated. With the terminators in place, the board could be placed as far as one kilometer away from the NT. In practice, most installations are much closer, and connector blocks are not required.

Q) How do I ensure that my LAN Fax application supports the ISDN board?

The only sure way is to contact your application provider, but some other identifiers are:

- The green LEDs should be flashing when the LAN Fax application is ready to send or receive faxes.
- The Faxinit output, which is often logged in file *faxinit.log* in *winnt/bfax* in NT applications, includes ISDN daughtercard specific information.
- The firmware version distributed with the LAN Fax application should be version 1.80 or above.

Q) Why does my green LED never flash?

The application software has probably not initialized the ISDN daughtercard. You should contact your application vendor for appropriate updated files.

Q) My green LED flashes, and is mostly OFF. This happens after I attempt to place a call. Why?

See the reply to "*How do I know if my datalink is point-to-point or point-to-multipoint?*"

Q) Why does the board not answer any calls, and when I attempt to dial out, do I receive a final call progress of "Quiet T.30 time out" with the green LED flashing?

It might be that the application you are using is correctly initializing the daughtercard, but is not using the correct TR114 firmware. Version 1.80 or above is required.

Q) How do I know if my datalink is point-to-point or point-to-multipoint?

Symptoms of a datalink mismatch are:

- Cannot send or receive faxes.
- The green LED associated with the channel attempting to place the call is mostly OFF, and briefly flashing ON after you have attempted to place a call.
- When you attempt to place a call your application returns with SIT INTercept (ISDN Cause: 80 9b).

If you have these symptoms, you should configure the board to use the other datalink protocol.

If this does not resolve the problem, the ISDN cause for the disconnection and a protocol trace should be obtained, as shown in the section covering the on-board protocol analyzer.

The *debug.txt* and *britrace.txt* files should be included with the information describing the symptoms of the problem and the status of the Green LED. These should be forwarded to Brooktrout technical support.

Q) I have my board installed in Spain, and it appears to work correctly on both point-to-point and multipoint datalinks. Which datalink should I choose to configure the board?

Some PTT connections in Spain allow both datalinks types to be used without reconfiguring the line. This is achieved by applying the standards in a novel way. When the ISDN TR114 is used on such a line, and it is the only device on that line, the Spanish PTT recommends use of the point-to-point datalink.

Q) Why does the board not answer any calls even though it can fax out correctly? I have the DID service and I receive 3 DID digits from the local PTT.

You probably need to check the *did_digits* setting. Verify your configuration by running `faxtest -u 0 -e -v -r`. You should see a *debug_data* entry on the screen when you attempt to receive. For example:

```
11/10 13:23:45.37 0 intr: 0x14 DEBUG_DATA 0x0

11/10 13:23:45.37 0 Debug string: An incoming call
has been detected with 3 digits in Called Party
Number

11/10 13:23:45.37 0 intr: 0x14 DEBUG_DATA 0x0

11/10 13:23:45.37 0 Debug string: An incoming call
has been detected with 0 digits in Redirecting Number
```

This shows the call was rejected after 16 seconds because 3 digits were received, but *did_digits* was set higher. Simply set *did_digits* to a value of 3 and retest.

Q) I do not know how many DID digits I should be receiving. How do I check?

Using the configuration and diagnostics CD, edit the file *user.cfg*. Change *did_digits* to 20. Run `faxtest -u 0 -e -v -r`.

Place a call into the system from a telephone or fax machine. The call will be rejected after 16 seconds, but a *debug_data* entry is displayed on the screen indicating how many digits were received (see previous FAQ). You can now configure *did_digits* to this value (assuming fixed number of digits).

Q) Why can I receive calls with the board behind my PABX, but not originate any?

Some PABX expect a Calling Party Number to be presented by the TE. First, try to originate a call in the enhanced mode to determine and note the ISDN cause code for the disconnection. Try running *faxtest* with the -c option. For example, run

```
faxtest -u 0 -c <cpn> -s <number>
```

where <cpn> is a valid number programmed in the PABX as an MSN/DID number for that particular port. If this works, the CPN can be programmed into the board using the *briconf* program. Check the cause code against the previous attempt.

Some PABX require a channel identifier. Try adding the line:

```
bchan_sel 3
```

to your *bri.cnf* file and re-configure the board. If this does not work, check the *briconf.txt* file for further *bchan_sel* options.

Q) I can receive calls with the board behind my PABX, but when I originate any, the call is accepted and then disconnected after four seconds. What is wrong?

The PABX is expecting a CONNECT_ACKNOWLEDGE message from the board. This is an optional message, and can only be enabled in daughtercard firmware versions 2.11 or above.

Q) I get calls rejected from a certain fax number, but I can send faxes to other numbers. If I dial the fax number from a telephone, I can hear the fax machines CED tone. Why?

Some private networks and local exchanges do not correctly handle outgoing bearer capabilities set to 3.1k Audio, and might reject calls incorrectly. This can be confirmed using the enhanced *faxtest* program. First, use *faxtest* in the enhanced mode as usual, and note

the disconnection cause code. Then run *faxtest* using the `-b` option. For example:
`faxtest -u 0 -e -b -s <number>`.
Check the cause code against the previous attempt.

If you want all calls to be placed using a speech bearer capability, the board can be configured using the *briconf* program.

Q) Does the board require power from the ISDN network?

No, the ISDN board does not require additional power from the network or PABX. Within the EuroISDN standard, the network has the option of providing additional power. Therefore, stimulus devices such as telephones do not require their own power supply. Many PABX do not provide this additional power source.

Q) I am in the UK and will be using a direct British Telecom connection. What service should I request, and what is the best way to configure the board?

The newer ISDN2e BRI service available from BT is recommended since this provides 100% EuroISDN compatibility. Point-to-point datalink is not available in the UK, and some local exchanges do not correctly handle a 3.1k Audio bearer capability. We advise the following *bri.cnf* settings, with TR114 firmware 1.8a or above:

- `datalink pmp`
- `bearer speech`

Q) My LAN Fax application has a pull down list to select the board type, but it does not include the TR114+2B or +4B. What do I select?

Since the ISDN board returns the DID number in the same way as our DID range of boards, select TR114+2D or +4D as alternatives to TR114+2B or 4B

Q) I want to dedicate some fax channels as outbound only in my LAN Fax application. What do you recommend?

In cases where you want to dedicate certain channels for outbound or inbound use, we suggest the following:

- Dedicate whole ISDN ports to outbound faxing.

  or

- Dedicate only odd numbered channels to outbound faxing, and even numbered channels (including zero) for inbound faxing.

  This method is more efficient because of the ISDN bearer channel-to-TR114 channel mapping.

For example, if you wanted to dedicate one line for outbound only, and one line for inbound using the TR114 + I4B, the following would be suitable:

```
Fax0 - In/Out Fax1 - In/Out Fax2 - In Fax3 - Out
```

Q) I am receiving 15 digits from Deutsche Telekom in overlapped receive, but my RightFAX application can only route on 9 digits. How do I correct this?

You can configure RightFAX to strip off leading digits in the following manner:

In *HKEY_LOCAL_MACHINE/Software/RightFAX/BoardServer* enter the following keys:

- MaxDIDDigits:REG_DWORD: Maximum number of DID/DNIS digits to use. For example, if set to 5 and DID received is 773288267493 then result is 67493
- ISDNPreamble:REG_SZ: Digits to prefix onto DID/DNIS (after MaxDIDDigits is enforced). Total digits are still limited to 9

Q) When I use the configuration and diagnostics CD, I can send and receive faxes correctly. When I use my Facsys application I cannot, and my ISDN configuration appears to change back. What do I do to correct this?

FAXMNGR versions prior to 01.02.112 downloaded the daughtercard firmware at startup, and consequently lost all configured settings. This download is unnecessary, and can be disabled by setting the registry variable

`FaxManager\Devices\Line##\BriDownLoadInhibit, REG_DWORD` to 1. Download the firmware to the board again and reconfigure prior to use. FAXMNGR versions 01.02.112 and above disable the unnecessary download by default.

Q) Which AOC service should I use?

Although the ISDN TR114 can interwork with all the varieties of AOC, we recommend AOC-D with a unit type if there is a choice available. You need to confirm that your application can support this. We recommend this because:

- Implementation is consistent across different countries.
- Applications are more likely to support unit type, because it is simpler and equivalent to earlier analog call charge schemes provided by public networks.
- If the line disconnects prematurely the ISDN TR114 can return the last received subtotal to the application.

Q) How do I check if my ISDN service includes AOC reporting?

The simplest way is to use the *faxtest* program from the configuration and diagnostics CD. When the `-e` option is specified, additional ISDN information is reported, including call charge. This shows whether the AOC service is available, and what type of service is provided: unit or currency. Some countries, such as Spain and the UK, do not provide the AOC service. For AOC reporting, daughtercard firmware version 2.10 and TR114 firmware version 1.90 are required.

Q) Can I use an ISDN board and an analog board in the same system?

You can mix any TR114 series boards within the same system. The TR114 firmware IS important. The standard analog boards have 1M RAM per-channel, and the ISDN board has 2M RAM per-channel. The current firmware (**-164.pex*) is 1M firmware that can be used on 1M or 2M boards, the newer 2M firmware (**-2m.pex*) can only be used on 2M TR114s. Applications developed using our APIs prior to API 4.0 cannot transparently support both firmware versions, and you have to select one or the other. For a mixed system, in API 3.6 or 3.7 (virtually all LAN Fax applications) the

1M firmware (*-*164.pex*) must be used. Firmware versions 1.80 and above are suitable for use on the ISDN board. For example, a suitable firmware would be *v18a-164.pex*.

The *country_code* in *btcall.cfg* should be set to match the analog board.

Q) What is the maximum number of fax channels I can have in one system?

The current limit is 96 fax channels per chassis. Since this would involve 24 TR114+I4B's (48 ISDN BRI lines), the real limit is likely to be somewhat less due to chassis or power considerations. For channel counts of 12 or more, Brooktrout's primary rate solution might be more suitable and cost effective. Here, a single NIC (Network Interface Card) can provide up to 60 communication channels. This NIC would connect via an internal telephony bus (MVIP) to high density digital fax/voice boards. This allows for future 60-channel solutions using only 5 slots. Multiple NICs can be installed in the same chassis for even higher densities.

Q) I have my ISDN ports configured for cyclical hunting to distribute incoming calls, but all even numbered channels seem to have much more traffic. Why?

For incoming calls, calls on either bearer channel (B1 or B2) are collected by the lowest numbered TR114 channel associated with that port. This can lead to even numbered channels (including zero) handling a higher proportion of traffic than odd numbered channels in lightly loaded systems with cyclical hunting.

Q) When I call my dial-tone provider with the ISDN board, it does not work, but it does work when I use my Analog board. The dial string I usually use is 1234567,,,,,,,,1234w1234567. What is happening?

Call setup is entirely digital and out-of-band with the ISDN board. The one-second 'waits' and the 'wait for dial-tone' are ignored by the board. In this case, it dials the number 123456712341234567.

Glossary

B Channel	One of the ISDN line's bearer channels. Operates at 64 kbit/s and carries voice, fax, data, or video.
BRI	Basic Rate ISDN service. Provides two bearer channels operating at 64 kbit/s for circuit-switched voice, fax, and data and one D channel operating at 16 kbit/s for packet-switched data and call set-up and call control signaling.
Channel	One of the TR114 channels that transmits or receives fax or voice data over an ISDN line's B channel and call set-up and call signaling over the ISDN line's D channel.
D Channel	The ISDN line channel that carries call control and call set-up signaling (out-of-band signaling). Operates at 16 kbit/s and can carry packet-switched data.
DDI (DID)	Direct Dialing Inward (Direct Inward Dialing). A user network access method available on groups of ISDN lines. Assigns the group of ISDN lines a range of consecutive telephone numbers in blocks of 10, 100, 1,000, or 10,000 numbers.
Hunt Group	A logical access made up of multiple ISDN lines on which the telephone company can deliver incoming calls. To deliver a call, the telephone company searches the hunt group for a free B channel.

Immediate-Start A DID service option where the telco waits a fixed amount of time after seizing the line before it sends the DID digits to the board. Then, when it detects or fails to detect the correct number of DID digits, the board responds the same as it does when configured for *wink-start* service.

ISDN Integrated Services Digital Network. Provides dial-up digital access to worldwide telecommunications network over twisted-pair telephone lines.

ISPBX Integrated Services Private Branch Exchange. An ISDN PBX.

MA/LH Multiple Access/Line Hunting. A user network access method available only on groups of ISDN lines. The group of lines forms one logical access, reached through any telephone number in the block of assigned DID numbers.

MSN Multiple Subscriber Numbers. Usually available on individual ISDN lines. Assigns a block of telephone numbers, typically 8 to 10, to the line. The telephone numbers are not necessarily consecutive numbers.

Network Termination Equipment Termination devices that provide the interface connecting subscriber 4-wire equipment to telephone company 2-wire equipment. Installed on subscriber premises, defines the demarcation point between PSTN and subscriber equipment. Types are NT1 and NT2:

NT1

Network termination type 1. A 2-wire (PSTN)/4-wire (subscriber) interface. Installed at your site, it terminates the public ISDN network, supplies power to the ISDN line and your ISDN devices, and performs maintenance functions.

NT2

Network termination type 2. An intelligent device that performs higher-level functions, such as switching and concentration. Examples are an ISPBX, LAN, and a terminal controller.

Reference Points

Specifications defining the links that connect devices on an ISDN network and their communications protocols. ISDN standards define three user (subscriber) reference points, R, S, and T and two Central Office (CO) reference points, U, and V:

R

An analog interface linking a TE2 to a Terminal Adapter (TA). Tied to country-specific standards, it typically complies with an X series and V series of ITU-T recommendations.

S or S/T

A four-wire digital connection linking individual TE1s or TE2s to their NT1. It separates individual terminals from network-related communications functions.

While the S and T points are electrically identical, the S point links a TE1 or TE2 to an NT2, and the T point links them to an NT1.

U

Two-wire digital connection linking the NT1 to the Central Office. Also known as the “local loop.”

V

The interface at the Central Office that links a line termination (LT) device with an exchange termination (ET) device.

SUB

Subaddressing. A user network access method that includes subaddress digits in the dial string. Usually included with basic service and often available with MSN and DID accesses.

TA

Terminal adapter. Protocol converter that enables old analog equipment (hardware and software) to communicate with the ISDN network.

Terminal Equipment

Any user device that connects to an ISDN line through an NT1. Types are TE1 and TE2:

TE1

Terminal equipment type 1. An ISDN telephone, computer, fax machine, or other equipment that you can connect to ISDN service without going through a terminal adapter (TA).

TE2

Terminal equipment type 2. An old, analog telephone, modem, fax machine, or other equipment that you used to connect to analog phone service. For ISDN, you connect it to ISDN service through a terminal adapter (TA).

User Network Access Method

Defines how the subscriber's equipment connects to the ISDN network and accesses ISDN services. Some methods are included in the basic service, while others are supplementary.

Which access method a subscriber selects depends on several factors: the number of BRI lines installed, the type of equipment connecting to ISDN service, and whether the installation includes an NT2 (for example, an ISPBX or LAN).

Wink-Start

A DDI service option where the board performs a "wink" after it detects seizure of the line; that is, it momentarily reverses the voltage polarity applied across the phone line (i.e., tip and ring), signaling the telco that it is ready to receive the last few digits of the dialed number.

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